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The Apprentices

THERE is a steadily growing demand from the supervisors of apprentices and apprentice instructors for some way in which they can be brought together to exchange experiences and discuss their mutual problems. The suggestion has come from several sources that Division V might find some way in which a strong committee on apprenticeship could be appointed and that if it did not seem desirable to have the Division spend its time discussing apprenticeship and its details, ways and means might be found for having the apprentice group meet separately some time during the annual meeting. It has also been suggested that there may be possibilities in having some of the more advanced and ambitious apprentices visit the exhibit under guidance and study those parts in which they may be particularly interested. It has not been at all unusual to have some of the apprentice supervisors and apprentice instructors attend the big meeting, and occasionally an apprentice from a nearby road might drop in with his father or some relative. The visit of the delegation of ten Erie apprentices this year is believed to be the first time that a group of apprentices have attended the convention and systematically looked over the exhibits under the direction of an apprentice supervisor. It will be interesting to know just what the reaction from this will be when the boys return home and settle down on the job.

To Clinch the Argument

THE report of the Joint Committee on Locomotive Utilization, which was read at yesterday's session of the Mechanical Division, presents in a few pages a remarkably concise summary of practically all of the things which can be done to procure the maximum service from steam locomotives. Furthermore, the methods outlined, if fully carried out, will, in most cases, result in a minimum maintenance cost per unit of locomotive service. The greatest results of the committee's work have, however, probably come about as the result of the influence it has exerted during the conduct of its field surveys, rather than as a result of its reports. The work of the committee has now progressed to a point where the scope of its influence might be increased by a detail analysis of the results of these methods for increasing utilization where they have been most extensively applied and the inclusion in its next report of such an analysis of as many cases as the time and resources of the committee will permit. Much of this data is, no doubt, already available and the future work of the committee will bring out even more convincing evidence than that now in its hands.

Division V and the Human Element

CHAIRMAN SILLCOX of the Mechanical Division in his closing address yesterday touched upon a number of important matters which in his opinion should receive consideration on the part of the Division in developing its program for the coming year. It is significant that he placed stress upon certain phases of what might be termed human relations, specifically mentioning apprenticeship and foreman training. While Mr. Sillcox made no reference to it, a careful check of the program and proceedings of the Mechanical Division meeting this year fails to disclose any consideration of matters of this nature. On the other hand, there are not a few mechanical department officers who feel strongly that the greatest possibilities of more efficient and more economical operation, so far as the mechanical department is concerned, lie in improving the standards of supervision and selecting, training and inspiring the rank and file, so that there will be developed the greatest possible degree of intelligent co-operation. It is vital that the railroads as a whole should develop standards and recommended practices through the Mechanical Division but is it not just as important to study and discuss the so-called human relations and managerial problems? The American Railway Engineering Association has a standing committee on the economics of labor. The mechanical department officers have much larger numbers of men under their direction and it would seem that a similar committee, or several committees, covering the various phases of the human relations and management problem could function to special advantage. Mr. Sillcox has made a suggestion which, if followed, may greatly increase the value and prestige of the Mechanical Division. Just as the technical engineer has had to broaden his field by going beyond the

utilization of the forces and materials of nature to include the direction of human activities in connection therewith, so it would seem that the Mechanical Division should broaden its program to include the great problem and possibilities of improving the directing of the human element.

Use the Dynamometer Car

AS undesirable as the practice may be, it seems that there are many roads which fix train ratings by a calculative method. The maximum utilization of locomotives demands the collection of accurate road service data from which to determine whether or not the greatest possible service is being obtained from locomotives. Obviously the use of the dynamometer car would be the best method to make such a determination accurately. Unfortunately, it is not possible for every road to make use of the dynamometer car because of the fact that there are less than a dozen in the country at the present time. The study of train ratings should be an important function of the mechanical department. The broad questions of fuel conservation, locomotive operation and maintenance are closely identified with the proper loading and speed of trains. It is not sufficient to lay down a definite set of calculated train ratings, which must of necessity be based upon average speeds over tonnage districts. Actual and continual test runs should be made to enable the mechanical department to tell the transportation men what deviations may be made from fixed ratings to accommodate changed conditions.

When it is considered that a modern dynamometer car costs little more than a single modern locomotive, it seems false economy to continue to control operation by present methods, not to mention the wealth of valuable data which might be used more intelligently to order locomotives better suited to individual operating conditions.

The Other Mechanical Associations

THE work of the mechanical departments has become so big and complicated that no one associated should be expected to cover all of its activities in detail. The parent or overhead organization, Division V-Mechanical, must necessarily restrict its activities to some of the larger and more important problems and to the broader aspects of the work of the mechanical department. There must logically be a number of allied organizations to go thoroughly into many of the more complicated and highly technical details which it would not be productive or possible for the Mechanical Division to consider. That Chairman Sillcox of the Mechanical Division is keenly awake to the importance of the work of these allied mechanical associations is indicated by the graceful reference which he made to them in his closing address yesterday. It is really unfortunate that some way cannot be found whereby the Mechanical Division can render a larger degree of assistance and encouragement to the smaller association. It is fortunate, however, that in most cases the officers of these allied associations are keenly awake to the needs of their members and are putting over constructive and forceful programs. While occasionally some of these associations may slow up or slump, it should be a matter of no small satisfaction to the railroad that all of them are at this time functioning with unusual efficiency. The Air Brake Association, the International Railway Fuel Association, and the Master Boiler Makers' Association have already held their annual meetings with most satisfactory results. Information that we have received about the programs of the other organizations which will meet during the summer and early fall, confirms the fact that almost without exception they expect to put on the strongest and most constructive programs in their history.

Battering Down the Departmental Barriers

ONE of the most constructive influences which has resulted from the co-ordination of the effort of the associations of officers in the different railroad departments which the American Railway Association has brought about is concretely illustrated by the Joint Committee on Utilization of Locomotives. This committee, made up of operating officers and mechanical department officers representing two divisions of the parent association, is doing much to create in the minds of the officers of both these departments a consciousness that they are, first of all, railroad officers and that their connection with one or the other of these departments is really of secondary importance. It augurs well for the future progress of railroad transportation that the old idea of the professional trainmaster and a professional master mechanic is giving way to this broader conception of what it means to be a railroad man.

A Saving Sense of Humor

RAILROAD mechanical men need a sense of humor—the more important their positions, the greater the need. Take a superintendent of motive power, for example, with the tremendous responsibilities involved in the efficient expenditure of perhaps twenty or thirty million dollars annually and the employment of twenty or thirty thousand men. The living and, to a considerable extent, the happiness of these men and their families are dependent on the judgment of the chief motive power officer. If anything goes wrong with the mechanical machine resulting in inadequate service or costly maintenance, he is the man called to account. In case of accident or wreck due to defective equipment, he is responsible. There is a very definite limit to the extent to which the superintendent of motive power on a large road can personally know the details of work performed by the mechanical department, and yet he must answer for every detail in case of trouble, being confronted with the trying and nerve-racking task of selecting men who will look out for each detail without fail and assure smooth functioning of the mechanical machine. The responsibilities of a superintendent of motive power, and of other mechanical department officers in proportion, are such that a conscientious man can readily spend all the hours of the day and many night hours as well, working, analyzing, thinking and often worrying about what will happen on the next day. We submit, therefore, that it is wise for him to realize to the full his responsibilities and yet refuse to take himself too seriously. By being on the alert to catch the humor of such situations as lend themselves to humorous interpretation, he will be in a far better state of mind to perform his duties effectively.

Study the Broad Phases of Railroading

SOMETIMES mechanical department officers are prone to complain that they seem to have little in common with the executive officers and those of other departments. There is, undoubtedly, considerable justification for such a complaint, as the work of the mechanical department includes many detail operations, the understanding of which can only be acquired through years of study and experience. The problems confronting the average mechanical department officer are many, they are of a highly specialized nature and the job of meeting them takes practically all of his time. This is perhaps the principle reason that the opportunity for him to get a clear insight into the problems of such departments as the operating and traffic is not as good as that of the officers of the maintenance of way department, the work of which is more closely interlocked with those departments. Few mechanical department officers have been selected to fill executive positions, as compared with those taken from other departments, although there are many mechanical department men who are quite competent for such work. Study of and interest in the problems of other departments should be a big help to the mechanical department man desiring to go higher and should also eliminate the criticism that the mechanical department officers are merely "one department men."

Is Your Electrical Work Really Organized?

FEW things are more apparent than the fact that our everyday methods of living are getting more and more complex. Similar complexity is also evidenced in the many new types of equipment used in railroad service. It is particularly interesting to note that the use of electricity is responsible for a large part of these innovations. Good electric light makes good working conditions. Several motors on one machine with automatic control make modern machine tools possible. Welding permits the making of "in place" repairs. The oil-electric locomotive and the gas-electric car are demanding attention. The only time that car lighting is ever noticed is when it happens to be poor. The use of electric motive power is slowly but steadily increasing and on the steam locomotive, electricity is used for lighting and for the operation of speed indicators and train control equipment. These devices and many more of their kind greatly increase the complications involved in running a railroad, but they also result in better and safer operation and make it possible to meet the steady increase of traffic without increase of track mileage.

In spite of all these improvements the statement is made repeatedly that railroads have been backward in adopting electrical apparatus. This is probably true to some extent. The big electrical manufacturers have found it easier to develop other markets, power companies have been indifferent to railroad power requirements and it is extremely difficult properly to co-ordinate the electrical work done by the various railroad departments. The first two limitations are being rapidly removed, but the latter is in need of attention. A few roads have electrical engineers who are responsible for all electrical work, but in many cases the electrical work is done independently in the different departments with corresponding lack of co-ordination. On one road the sole duty of one man is to keep informed concerning the electrical work done by different departments and to advise all those concerned what equipment should be purchased and thus avoid the acquisition of a hodge-podge of different kinds which restricts interchangeability and complicates storekeeping and the making of repairs. The use of electrical equipment is increasing rapidly and now is the time to see if the electrical department can be made to function as it should. The best electrical man in the country cannot render adequate service to his road if he is hamstrung by department rules.

Are Railroad Power Plants Doomed?

AT THE meeting of the railway electrical engineers at the Hotel Dennis on Monday, a significant remark was made by the chairman of the Power Plant Committee in regard to the future outlook for railway power plants. It was stated that unless steps were soon taken to organize the steam power plants of the railroads on a much more efficient basis than that upon which the majority of them are operating today, the time was not far distant when such plants would pass into oblivion and in their place would be substituted purchased electrical energy. There is no question but that there is a strong tendency in this direction, and a number of roads are rapidly increasing the amount of electrical power purchased. Even if it were possible for railroads to generate their own power at a cost equal to that of purchased power, and there are few that can do so, there would still be a decided advantage in not having to concern themselves with this problem which, strictly speaking, lies beyond the true sphere of railroad operation. The hazard of power failure which may once have been considered as a detriment to the use of purchased power, has been in a very large measure eliminated by the extensive interconnection of transmission lines which now form a vast network extending over a large part of the territory where electrical power is utilized. It has been estimated that only 25 per cent of all the power used in this country is generated in isolated plants. Interconnection of power systems assures almost certain continuity of power supply under any conditions of load that may arise.

Various railroads throughout the country that are at present generating their own power have estimated the cost per kilowatt hour to be from five mills to eleven mills. Costs as low as this can only be secured by roads which are favorably situated as regards coal supply, and those which fall in this classification are relatively few. In the great majority of cases the power cannot be developed by railroads at a cost which can approximate this, and for such roads there is no question but that purchased power is both cheaper and better. The generation of electric energy may well be considered as a business by itself. It has made tremendous strides during the last decade. Equipment and facilities have been incorporated in central power stations which are practically prohibitive for any railroad to install, with the result that such power stations will always be able to develop power at a lower cost than railway plants. Nor is the end yet in sight, for there is every reason to believe that such improvements will continue and that even lower rates for power will be available as time goes on. In the face of such conditions as this, the advantage of continuing the use of railroad power plants for generating electric power becomes highly problematical and the question may well be asked "Are not railroad power plants doomed?"

R. S. M. A. Vacancy Filled

THE election of Gilbert E. Ryder as vice-president of the Railway Supply Manufactuers' Association, made a vacancy on the Executive Committee from the New York district. The Executive Committee at a meeting on Tuesday elected Franklin H. Smith of the Gold Car Heating & Lighting Company to fill out Mr. Ryder's unexpired term.

Final Enrollment Figures

THE following table tells the complete story of registration at the last three big conventions at Atlantic City. The total attendance has surpassed the previous high record by something over 400.

	1922	1924	1926
Division V—Mechanical	1,008	1,223	1,405
Division VI—Purchases and Stores	384	434	480
Special guests	947	1,111	901
Railroad ladies	1,036	1,201	1,198
Supply men	2,304	2,670	3,135
Supply ladies	575	676	725
Totals	6,254	7,315	7,844

R. S. M. A. Committee Appointments

ALTHOUGH it is quite probable that the next big convention with exhibits will not take place until 1928, "Doc" Bateman, the incoming president of the Railway Supply Manufacturers' Association, has already appointed the chairmen and vice-chairmen of the various committees which will function during his term of office. They are as follows:

Exhibit Committee:—S. G. Down, Chairman, Westinghouse Air Brake Company, Wilmerding, Pa.; Geo. T. Johnson, Buckeye Steel Castings Company, Columbus, Ohio; D. L. Eubank, Galena-Signal Oil Company, Atlanta, Ga.; R. J. Himmelright, American Arch Company, New York, N. Y.; and H. E. Daniels, West Disinfecting Company, Railroad Department, Chicago, Ill.

Finance Committee:—Charles H. Gayetty, Chairman, Quaker City Rubber Co., Wissinoming, Philadelphia, Pa., and Geo. L. L. Davis, Scullin Steel Company, St. Louis, Mo.

Badge Committee:—Franklin H. Smith, Chairman, Gold Car Heating & Lighting Co., Brooklyn, N. Y., and N. C. Naylor, Railway Steel-Spring Co., Chicago, Ill.

Hotel Committee:—C. C. Castle, Chairman, American Car & Foundry Motors Co., New York, N. Y., and V. W. Ellet, Hunt-Spiller Manufacturing Corporation, South Boston, Mass.

By-laws Committee:—Arthur Allan, Chairman, The Holden Company, Montreal, Canada, and W. E. Wine, Wine Railway Appliance Co., Toledo, Ohio.

Entertainment Committee:—J. W. Fogg, Chairman, MacLean-Fogg Lock Nut Co., Chicago, Ill., and F. W. Venton, Vice Chairman, Crane Company, Chicago, Ill.

Enrollment Committee:—J. E. Brown, Chairman, O'Malley-Beare Valve Co., New York, N. Y., and F. E. Dodson, Vice Chairman, United States Rubber Co., Baltimore, Md.

Transportation Committee:—Geo. R. Boyce, Chairman, A. M. Castle & Company, Chicago, Ill., and W. A. Houston, Vice Chairman, Joseph Dixon Crucible Company, Baltimore, Md.

Correction

In yesterday's *Daily* we said that J. H. Cooper of the Chicago office of the Pilliod Company was formerly with the Pullman Company. We are advised that we were in error, Mr. Cooper's former connection having been with the National Railways of Mexico.

The New Officers of the Mechanical Division

AS announced in the *Daily* of June 15, page 1829, L. K. Sillcox was unaminously elected chairman of Division V, Mechanical, A. R. A., and G. E. Smart was unanimously elected vice-chairman.

L. K. Sillcox

The election of L. K. Sillcox, general superintendent of motive power of the Chicago, Milwaukee & St. Paul, brings to the chairmanship a man notable for many of the qualities which, engendered in American railroad men at large, are responsible for the present status of the railroad machine, enabling it to handle the country's business with maximum safety and despatch. Mr. Sillcox is known quite generally throughout the country as one of the hardest working executives in the mechanical department, with a marvelous capacity for personal attention to details as well as ability to lay down general programs of work.

An able technician, as shown by a splendid record of achievement on various committees of the Mechanical Division, Mr. Sillcox appreciates fully the vital importance of the human element. He is modest, conscientious, unassuming and ever watchful of the best interests of his associates, human traits which have so endeared him to mechanical men on the Milwaukee and other roads that he is one of the best loved men in railroading today. Mr. Sillcox possesses unusual ability to develop and organize men and make them like to work. On the Chicago, Milwaukee & St. Paul he has inspired his entire staff with much of his own intense loyalty to the road and willingness to work to the limit in its interests.

Aside from his family and church, Mr. Sillcox has practically no interest but railroading. His avocation is the reading of books on railroad subjects. He directs a boys' club at his church in Riverside, one of the suburbs of Chicago, and it is said seldom misses one of the regular meetings. The progress of his own apprentice boys on the Milwaukee is watched with the keenest interest and solicitude, a large board in his office bringing constantly to his attention the personal record of each boy.

Mr. Sillcox prepares a large number of papers and addresses each year for presentation in the technical press and before railroad clubs, universities and various chambers of commerce. He is a member of the American Society of Mechanical Engineers; American Society of Civil Engineers; American Institute of Electrical Engineers; American Institute of Mining Engineers; American Institute of Chemical Engineers; Franklin Institute; the Institutes of Locomotive Engineers, Mechanical Engineers, and Electrical Engineers, all of London; Ameri-

can Society for Testing Materials; American Association for the Advancement of Science, and the American Academy of Political Science. He is also a member of the University Club of Chicago.

Mr. Sillcox became a member of the Master Mechanics' and Master Car Builders' Association in 1916 and has served with distinction on a number of committees of that association and its successor the Mechanical Division since that time, as follows: 1920—Couplers and Draft Gear; Specifications and Tests for Materials; and Depreciation for Freight Cars; 1921-22—Car Wheels; Couplers and Draft Gears; and Design, Maintenance and Operation of Electric Rolling Stock; 1923—General Committee; Electric Rolling Stock; and Wheels; 1924—General Committee; Car Construction, and as chairman of the committee on Electric Rolling Stock; and, 1925—General Committee; Car Construction, and Electric Rolling Stock.

L. K. Sillcox
Newly Elected Chairman of the Mechanical Division

Lewis Ketcham Sillcox was born April 30, 1886, at Germantown, Pa. He was graduated from Trinity School, New York, N. Y., 1901, and the Polytechnic School of the University of Brussels, Belgium, 1903. He entered railway service, July, 1903, as roundhouse apprentice, New York Central & Hudson River at High Bridge, N. Y.; 1906 to 1909, molder and assistant superintendent McSherry Mfg. Co., Middletown, O.; 1909 to 1912, shop engineer, Canadian Car & Foundry Company at Montreal; 1912 to 1916, mechanical engineer, Canadian Northern Railway System at Toronto, Ont.; 1916 to 1918, mechanical engineer, Illinois Central; 1918 to June 1, 1920, master car builder, Chicago, Milwaukee & St. Paul at Milwaukee, Wis.; June 1, 1920, to August, 1920, assistant general superintendent motive power of the same road at Chicago; August, 1920, to date, general superintendent motive power of the same road at Chicago.

G. E. Smart

G. E. Smart, the newly elected vice-chairman, is chief of car equipment of the Canadian National and has been active in association affairs for several years. Mr. Smart was born in Edinburgh, Scotland, and entered railroad service in the car department of the Grand Trunk in 1892. His railroad career has been confined entirely to Canadian railways. He went with the Canadian Pacific in 1904 and in 1913 was appointed master car builder for the Canadian Government Railways. Six years later he was elevated to the position of general master car builder for the Canadian National, later spending three years as mechanical assistant to the vice-president of the same road, which position he was occupying when appointed to his present position early in 1923.

G. E. Smart
The Newly Elected Vice-Chairman

Much interested in railway club activities, Mr. Smart is one of the charter members of the Canadian Railway club. He was a prominent factor in the early meetings of this club and at one time served as its president.

Mr. Smart became a member of the former Master Car Builders' Association in 1910 and has always been a critical student of matters pertaining to the car department as handled by this association and subsequently the Mechanical Division. In 1920 he served as a member of the Committee on Brakes and Brake Equipment and in 1924 on the Committee on Rebuilt Cars. He was elected a member of the General Committee of the Mechanical Division in 1924.

Good Lighting Equals Public Demands*

Points of Vital Importance for Success in Lighting Passenger Cars—Equipment and Maintenance Both Required

By C. G. Juneau

Master Car Builder, Chicago, Milwaukee & St. Paul

IN VIEW of the almost universal demand on the part of the traveling public for better lighting in railway equipment, those having to do with this particular branch of the service must of necessity give it continual thought and study to bring about the desired ends. A careful study of the relative costs for furnishing suitable electric lighting must be made especially so where railroads still offer oil and gas lighting to the traveling public. We feel that in order to accomplish this a suitable design of headlight generator, or in the case of motor cars, properly designed mechanically driven units in conjunction with batteries, will have to be furnished.

In order to obtain the desired end under any plan the following factors are essential:

1. A suitable method of installation.
2. Proper voltage regulation so as to give uniform lighting.
3. A proper design of equipment.
4. An adequate program of maintenance.
5. A reliable check on conditions and requirements.
6. A systematic program of judging current public requirements and desires.

Method of Installation

The first thing to be given consideration in connection with the installation is the class of material needed to meet the requirements, such as insulated wires and cables. The manufacturers have given careful thought and study to producing electrical materials, and the products now on the market appear entirely satisfactory.

In the handling of the wiring, good workmanship is necessary and of great importance. The joints and splices must be made mechanically strong in applying wire to railway equipment, as it is at these points that the insulation usually fails. After a good mechanical contact has been made and soldered, the joint should be carefully wrapped with tapes to make this particular part of the insulation as permanent as is possible.

Due to the burrs going toward the inside of the conduit while being cut, it is important that the inside of the ends be properly reamed. Where the conduit ends or enters into fittings, they should be protected by an approved bushing. The ends of the large conduit in which the main wires are run should be fitted with an insulated bushing as it is at this point where most failures occur due to the vibration of the car when in operation. It is felt that too much care and attention cannot be given to this particular part of the work. Conduit should be so arranged, and enough pull boxes put in, so that it can be made up and the wires pulled in afterwards. This method of application is suggested as it seems to provide for a better condition of maintenance and overcomes considerable cost in handling repairs.

The main switches and fuses, and branch switches and fuses, should be mounted on either a marble or asbestos ebony board and the whole placed in an iron cabinet. This cabinet is not necessary if the switch panel is placed in a locker in the car. However, when such lockers are used they should be properly insulated with suitable asbestos covering. Single pole switches, placed at various parts of the car to control single units, should be mounted on a metal plate, properly fitted over the junction boxes in which the wires are located.

This system of conduit is more necessary in an all-steel car than in one of composite design. Great difficulties are experienced in providing the all conduit system in cars already in service, and in some cases it is found to be practically impossible to install the full system. In building new equipment, it is an easy matter to provide a complete conduit system, and same can be properly installed at little expense. It is, therefore, essential that car designers cooperate to the fullest extent with electrical engineers so as to provide proper plans for the installation of the electric wiring.

Proper Voltage Regulation so as to Give Uniform Lighting

When electric lamps are manufactured they are of a pre-determined or fixed voltage. It is necessary to furnish this voltage if the rated candle power of the lamp is to be obtained. This can be accomplished in the axle design generator by an automatic voltage regulator or by a hand rheostat in the baggage car on such trains lighted under the head-end generator system. On locomotive turbine headlight generators the voltage is controlled by the speed governor of the turbine and in the windings of the generator. The regulating of the voltage is well taken care of by the manufacturers of car lighting generators and when conditions are normal good results obtain. One thing that is often overlooked by the layman is that an overloaded generator will not hold up its voltage and the natural result is poor lighting. This is caused by the turbine operating the generator slowing down in speed or, in the case of the axle driven generator, the slipping of the belt. When new turbine or axle generators are purchased it is essential that careful study be made of the load the generator is to carry, and in addition to provide for a suitable factor of safety. This is one of the most difficult problems confronting electrical departments in this present day, especially on locomotive head-lighted trains, as it is the practice of the transportation department to increase the number of cars in the train, which naturally places a greater load on the turbine. This is what makes it necessary to provide a factor of safety in order to meet an overloaded condition.

Uniform lighting throughout the train is important and it is felt this is more nearly accomplished by head-end dynamo baggage car turbine generators than by axle de-

* Submitted as a discussion of the report on Locomotive and Car Lighting presented on June 15, 1926.

vices. The reason for this is that a baggage car generator, lighting the whole train at the same time, impresses sufficient current into the batteries to cause them to float on the lines and stabilizes the voltage. Uniform lighting not only demands good voltage regulation but also the right number and proper placement of lights in the car.

Proper Design of Equipment

The important factors to be considered, and which are essential, are:

1. Artistic design and arrangement of fixtures.
2. Efficiency of maintenance.

There does not seem to be much chance of artistic design in the present construction of all-steel cars except in the general lines of the upper deck. There is more opportunity in the lighting fixtures but here we again find that efficiency of maintenance in a measure blocks design. We are inclined, generally, towards plain fixtures of smooth lines and surfaces, except in dining, parlor and observation cars. Sufficient latitude can be taken insofar as fixtures are concerned to provide pleasing designs, keeping in mind at all times that patrons of railroads, in the majority of cases, like an abundance of light.

Proper Maintenance Program

The problem of maintenance of equipment always confronts us. It entails proper organization of shop and terminal forces and the proper educating of terminal forces where daily inspections and running repairs are made, for the reason that unless this part of the work is properly handled much damage and embarrassment results. Practically all railroads have an individual method of handling the maintenance of equipment.

Reliable Check of Conditions and Requirements

It is important that originating terminals give proper attention and inspection to lamps, generator regulators, both axle and head-end baggage car generators, wiring, and electric fans, also the storage batteries. All of these must be tested daily before leaving the originating point. Careful record should be kept on suitable forms which will provide proper information as to the conditions and will also be an indicator to the shop forces as to the general conditions found in operation and better enable them to determine defects should difficulty be experienced, without the necessity of a great expenditure of money when cars are shopped. Such records will also in a measure expedite the work when cars are in shop.

Many interesting articles have been written on the subject of passenger train car lighting and its maintenance. In an article appearing in the Railway Electrical Engineer, March 1926 issue, W. J. Dawson, electrical engineer of the Kansas City Terminals, gives some interesting information on their method of handling this important work. The Kansas City Terminals having a large field in which to work on account of handling both axle and head-end lighted cars, Mr. Dawson has been afforded an opportunity to study the efficiency of practically all classes of equipment, and those who have not had an opportunity of reading this interesting article will be greatly benefited by obtaining a copy and studying over what has been said on the subject.

Another article appearing in the Railway Electrical Engineer in the issues of both February and April, 1926, by G. W. Wall, car lighting foreman, D. L. & W., brings out some interesting facts in connection with car lighting maintenance.

In the December, 1925, issue of the Railway Electrical Engineer there is an article on the practices followed on the Southern Pacific on axle car lighting maintenance. This dwells mostly on the operation and maintenance of 800 axle light generators, a large majority of which are body hung. A feature worth noting is that all pulleys are mounted on the center of the axle. The use of a 14-in. face pulley with 2-in. flange is provided. It seems to me that this width face pulley provides a suitable condition and is a happy medium between the 10-in. pulley now quite generally used and the 25-in. and 28-in. pulleys that are being experimented with to a great extent. They have also gone into the subject of belt clearances carefully, having located truck frames and brake beams so as to meet belt requirements, thereby reducing maintenance cost on this item. It is found in the operation of the axle generator equipment that lost belts constitute one of the greatest expenses, and also cause light failures which naturally brings considerable criticism from the traveling public.

Railroad Car Lighting from the Locomotive Headlight Generator

This system lends itself to a lighting field that has been more or less neglected. The people in the smaller towns on our railway are beginning to complain bitterly of the poor lighting obtained from oil lamps which are universally used in this service. Suburban trains have been pretty well taken care of on most roads but the branch line trains that reach out into farming districts demand immediate attention.

Our experience with this system of lighting proves that it costs less for operation than keeping up oil lamps and the satisfaction given to our patrons is such that a reasonable expense can be gone into to increase the use of electric lighting on branch line trains.

Lamp, Belting and Battery Costs

Electric lamps probably constitute one of the greatest items of expense in car lighting. There are several reasons, *i.e.*, rough handling of cars breaks many, variation in voltage of the generators, careless handling by employes and operating the voltage above the rated voltage of the lamps. Unfortunately this latter condition is more severe on head-end baggage car generator lighted trains than in axle generator equipped cars. On account of the drop in the main wires of a long train—12 cars—800 to 850 ft. long, the voltage of the head-end generator has to be carried from three to five volts higher than the lamp voltage. Although a three-wire loop return system is used and theoretically the voltage should be the same at the rear of the train as in the front cars, this is not the case on account of the overloading of the train wires on a 12-car train, and the lamps in the front cars burn out sooner than those in the middle or rear cars. However, when one considers that we have in service on our road about 36,000 lamps in cars, there is a great opportunity for breakage. While we are continually calling the attention of our yardmen and baggagemen to the care of electric lamps, there is still room for improvement.

Axle generator belting is a serious expense on axle lighted roads but these roads are continually working on this problem as articles already referred to point out.

The storage battery is our greatest expense in operating train lighting and the principal reason is the over discharge that they are continually subjected to. This resolves itself into an operating condition that can be overcome to a large extent by a larger investment in

batteries in order that there will be enough batteries on the trains so that they can carry the lamp load without becoming over-discharged.

You all probably know that sulphation of the battery cells does the greatest amount of damage to them and begins to act when the battery is discharged down to 57 volts in a 32-cell battery and 27 volts in a 16-cell battery, and becomes more active as the cells are further discharged. Bad sulphation in a battery can only be overcome by long charging and if thoroughly done, requires that the battery be taken out of service and great expense incurred.

Illumination of Steam Passenger Cars

"Light and not lamps determines economy of car lighting"—E. E. Dorting, lighting engineer, Interborough Rapid Transit Company, New York, Electric Railway Journal, July 13, 1924.

While Mr. Dorting's article is entirely devoted to the lighting of street railway cars, using five lamps in series, his digest of the matter is most complete and convinces one of the value of such a study.

His first sentence "Light and not lamps" applies to the lighting of railway passenger cars with equal force and it is along these lines that railway men have been working of late years. The manufacturers have greatly aided us by continually producing better lamps and better reflectors and by cooperating with us in tests, etc.

It is generally conceded that single, large lighting units located in the upper deck of the car, while perhaps not giving as even an illumination as a large number of smaller lamps, are satisfactory. The first cost and the maintenance is so much lower that it better meets present day efficiency.

These large lamps are generally enclosed in a semi-opaque bowl to prevent glare. The disadvantage of excessive glare is generally understood, but a recent test made with open front berth lamps brought it out so forcibly that the matter is worthy of mention. Our test was made in a sleeper equipped with open front berth lamps using 25-watt, P. S. 16 clear lamps, 3½ candle feet being the average light obtained. In the next car of the same design and color, with enclosed front berth lamps, using the same globes and carrying the same voltage, nearly six candle feet were read on the photometer. This was brought about simply because the glare from the open front berth lamps caused the eyes of the operator to contract to such an extent that he was unable to read the photometer correctly.

Wishes of the Public Should Be Met

The question of proper lighting for passenger cars is, from the standpoint of satisfactory service, an important one. It takes rank with questions of safety of train operation, speed and adequate temperature control. The lighting of a passenger car is one of the first things noticed by a passenger in case it is not proper. On the other hand good lighting is taken so much as a matter of course that on a passenger train it attracts no attention except from the most observing. The traveling public demands greater comfort and more luxurious surroundings than in the past and, whereas some years ago sufficient light to enable the passenger to see his way through the car was acceptable, today cars must be as brilliantly lighted as the homes in which the individuals live. This has forced greater attention to this subject. The improvement has been gradual and it may be expected that the future will demand even greater attention to those items that make for greater comfort to the travelers.

Adequate and proper lighting conditions involve the type of equipment, source of supply, design of fixtures and the proper use of the equipment provided. The type of equipment is of minor consideration because in these days the electrically lighted train is almost universal. In some cases oil and gas are still used to more or less extent but such cases are too few to be of general interest. Likewise the source of supply is almost universally the axle generator system. A few cases still exist where the head-end system is in use but these cases are rare. They are of importance, however, because there is some tendency to use the head-end system for the lighting of branch line trains and suburban trains, using the headlight generator for the dual purpose of lighting both the locomotive and train.

The design of fixture is of considerable importance, particularly in those cars provided for passengers who pay for special consideration. The fixtures should be such as to harmonize with the other parts of the car, should be artistic, and of the proper design technically to give most efficient light and at the same time be easily maintained. The artistic sense varies from time to time and this should receive consideration in providing the fixtures because it may be found necessary to change them, after a few years service, for a fixture that will be in keeping with the trend of the times. The location of the individual fixtures within the car demands attention in order that an efficient and pleasing lighting arrangement will be obtained.

The maintenance of the lighting equipment for passenger train service must be of very high order. In order that the equipment may be maintained in this manner without excessive expense requires special consideration to the material and workmanship which goes into the making up of the lighting system—including the generator, the belt which drives it, the batteries, switch board, fixtures, conduit and wiring. Too careful consideration cannot be given to the quality of insulated wire used in the manner in which it is installed. Trouble is often experienced through installing conduit in a manner that tends to collect moisture, either from direct entry or by reason of condensation. The batteries are worthy of expert attention, otherwise they will not be maintained in a condition that will render them available for 100 per cent service when they are called upon to meet an emergency. Unless properly maintained, their efficiency is greatly affected and you have a condition where comparatively great weight is hauled around which is of no practical value.

As above mentioned, the lighting of a car is one of the things that comes in for close scrutiny of the traveling public. It is therefore of extreme importance that some agency be made responsible for keeping in touch with changes that come about in matters of artistic sense and be prepared to offer suggestions for the altering of existing equipments to keep them strictly up to date. Unless this is done a car will soon take on the appearance of an old model and is likely to create adverse opinion.

As to the matter of lighting certain trains from a large capacity headlight generator, this is found in some cases to be an economical procedure and satisfactory lighting is entirely possible. This system avoids much of the maintenance expense involved in other systems but close maintenance standards must obtain to bring about satisfactory lighting conditions. Entirely satisfactory results have been obtained with this system in trains consisting of coaches, dining cars, sleepers and parlor cars.

Conventionalities

Walter H. Coyle, senior vice-president of the Franklin Railway Supply Company, was honored at the annual commencement exercises at St. Bonaventure's College, June 9, at which time there was conferred on him, in company with Mayor Dever of Chicago and a few other notables, the degre of LL.D. Dr. Coyle wears this new mark of distinction with becoming modesty. Mrs. Coyle and their daughter, Martha, are also attending the convention enjoying the entertainment and dancing. Dr. Coyle and his family are planning to sail for Europe, June 26, on the Belgenland, where he will make an extensive tour by automobile.

It has been said that history repeats itself with less difficulty than a golfer can duplicate a shot, especially if that shot is needed to win. We recorded in *The Daily* of Monday that Alex Turner qualified as a pinchhitter in a foursome at Seaview, sinking a long putt on the eighteenth green to win the match. In another foursome yesterday on the same course Mr. Turner had a lie on the eighteenth green that was probably within two inches of the identical spot from which he previously started his ball on its way into the cup. The putt was not a particularly easy one, being down hill and on a slightly rolling green. To sink it again meant to win. It sunk. All of which only further proves our previous comment that such a last putt pulls for "cool precision at a crucial moment."

George S. Oettle, who now represents the South African Railways at New York, is attending the conventions. Mr. Oettle came to this country to organize an office for the South African Railways in the United States and is especially interested in promoting travel from this country to South Africa. He was a speaker at the recent dinner of the American Railway Guild in Chicago and told his hearers many interesting things about the problems of the South African Railways and the methods they are using to solve them. He has been for years in charge of their development work. They have had many demands from farmers for the construction of new lines into territories from which there is a considerable traffic only for a few months of the year. The South African Railways already are paying a large amount of interest upon investment made in profitable lines in response to such demands from the agricultural interests. Within recent years, on Mr. Oettle's initiative, the South African Railways have adopted the policy of providing motor truck service to handle the crops in territories without railway lines. This experiment has been highly successful and they are now operating more than 3,000 miles of truck lines. Most of the trucks are of less than two tons capacity and are operated over unpaved roads. It has been found that this service can be so rendered as to satisfy the farmer and promote increased and more diversified production of agricultural products, and they impose upon the railways a much smaller investment and operating expense than would be necessary in order to provide rail service. A large part of the trucks used have been of American manufacture. The travel of American tourists in South Africa, which has a very pleasant and equitable climate, has been increasing within recent years, and lately a party of 350 Americans toured the country under the auspices of the American Express Company and the Royal Mail Steamship Company.

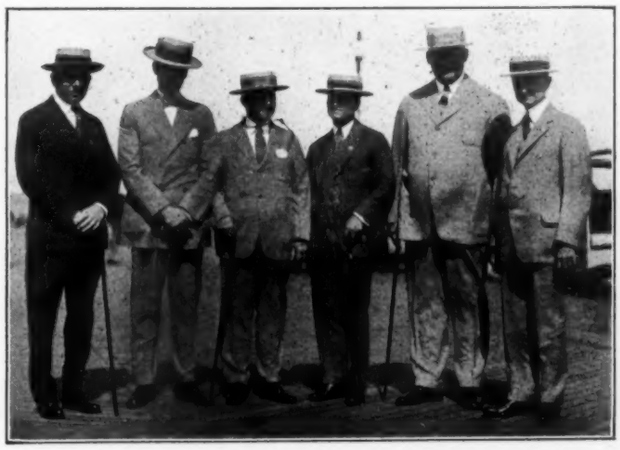
Many of the higher railroad officers are to be found among the attendants at this year's convention. In one party on Tuesday were R. B. White, senior vice-president, Central Railroad of New Jersey; W. A. Baldwin, vice-president, Erie, and W. L. Campbell, assistant to vice-president, Erie, accompanied by President Sinclair of the Sinclair Oil Company.

Prof. A. J. Wood, head of the Mechanical Engineering Department at the Pennsylvania State College, State College, Pa., arrived Tuesday morning. He was the main attraction at the Penn State reunion last night. Commencement exercises account for his late arrival. He reports that the college is graduating one of the largest classes in engineering in the history of that institution, but only a few of the class are entering railroad work.

H. H. Timken, president of the Timken Roller Bearing Company, accompanied by Vice-presidents M. T. Lothrop and T. V. Buckwalter, arrived yesterday from Canton, Ohio. In company with W. C. Sanders, in charge of railroad development, the Timken executives made a complete tour of inspection of the exhibits. Mr. Timken expressed marked interest in the development work not only as to standard equipment, but in relation to the newer types of transportation equipment.

The *Daily* had a new distinction conferred upon it yesterday when it received a call in a body from all of the three men most recently elected presidents of the Railway Supply Manufacturers' Association. Charles W. Beaver, who was president at the time of the last conventions, came in escorted by Leroy S. Wright, the retiring president, and "Doc" Bateman, the incoming president. Mr. Beaver has been out of active business for about a year and has been traveling a good deal of the time in Cuba, South America and Europe.

One of the "old-time" supply men conspicuous by his absence this year is W. F. (Billy) Heacock, whose experience includes service with such companies as the Chicago Pneumatic Tool Company, the Payton Lumber & Supply Company, and the Premier Staybolt Company. So many people asked for "Billy" that one of his friends got "a-yard-long" picture postcard and is getting some of them to send "Billy" a message of good cheer and the wish that he will soon be so improved in health that he will be back in the game.



Six of the Past Presidents of the Air Brake Association Attended the Atlantic City Convention

Left to Right: J. J. Cizek, F. W. Venton, J. F. Gettrust, L. B. Rhodes, Jos. Sinkler, J. Wright.

Registration, A. R. A.

Division V—Mechanical

Akitt, N. B., Mech. Draft., A. C. L., Breakers
Barry, J. J., Gen. M. M., N. & W.
Brenaman, H. A., Asst. Work Man., Penn., Chalfonte
Byron, A. W., M. M., Penna.
Campbell, J., Supt. Shops, L. V., Morton
Carmody, J. A., Supt. Elec. Equip., N. Y. C., Marlborough
Collinson, F. E., Mech. Eng., Can. Nat., Chalfonte
Cooper, W. J., Insp., Penna.
Cramer, C. B., M. M., W. T. Co., Chester Inn
Currie, H. A., Asst. Elec. Eng., N. Y. C., Marlborough
Dannell, John, M. M., B. & N. W., Continental
Davis, M. J., Asst. Eng., Penna., Chalfonte
Diven, James B., M. M., Penna.
Duke, W. D., Gen. Man., R. F. & P., Haddon Hall
Fletcher, C. C., N. Y. C.
Foltz, T. F., Gen. For., Wash. Term. Co.
Foss, M. A., Supvr. Boiler Insp., N. Y., N. H. & H., Flanders
Gallagher, J. E., R. F. E., P. & R., Sterling
Hamano, S., M. E., Japanese Government Ry., Chelsea
Hassett, M. W., Gen. M. M., N. Y. C., Haddon Hall
Haupt, H. H., M. M., Penna.
Heinbach, W. F., M. M., P. & R., Kentucky
Hodapp, J. E., Supvr. Loco. Opera., B. & O., Traymore
Hunter, M. E., M. M., L. & N., De Ville
James, F. T., Gen. For., D. L. & W., Osborne
Johnston, W. D., M. M., B. & O., Ambassador
Jones, H. W., M. M., Penna., Chalfonte
Kerby, Frederick, Supvr. Loco. Oper., B. & O.
Kinkead, J. M., Div. Eng., Penna.
Kobayashi, Joichi, Mech. Eng., Jap. Gov. R. R., Chelsea
Lawhon, A. M., M. M., So., Palace Royal
Leach, J. T., M. M., Penna., Iroquois
Linn, D. E., Asst. Supt. of Shops, B. & O.
McIlvaine, C. L., S. M. P., Penna., Brighton
McSweeney, E. J., M. M., B. & O., Ritz
Maxfield, H. H., S. M. P., Penna.
Melander, W. A., Secy. to Pres., N. Y. N. H. & H., Traymore
Mengel, J. C., M. M., Penna.
Merson, J. W., Shop For., B. & O., Brighton
Mewshaw, T. E., Asst. M. M., B. & O.
Nanney, T. H., M. M., B. & S., Haddon Hall
Nelson, F. W., M. M., N. Y., N. H. & H., Traymore
O'Donnell, John J., Gen. For., L. I., Dennis
Ott, W. B., M. M., W. J. & S.
Pearson, Harlow S., Traymore
Phettiplace, Charles, Haddon Hall
Phettiplace, L. H., Gen. Man., C. C. & O., Haddon Hall
Porter, W. B., Asst. Eng. M. P., Penna.
Pribble, B. S., Ch. Cl., to S. M. P., R. F. & P., Haddon Hall
Quinlan, F. T., Eng. Tests, N. Y., N. H. & H.
Rhoads, G. A., M. M., Penna., Brighton
Sheets, J. P. L., Gen. Shop Insp., Penna., Merchants
Shugars, Geo. C., Gen. Loco. Insp., P. & R.
Smith, H. E., Eng. of Tests, N. Y. C.
Smith, L. G., Elec. Eng., L. V.
Sturm, Otto, Gen. For., D. L. & W., Grand Atlantic
Takey, Akimichi, Mech. Eng., Jap. Gov. Rys., Chelsea
Tenfel, W. O., Asst. M. M., Penna.
Welloughby, Victor, Am. Car & Fdry. Co., Ambassador
Wible, T. E., Ch. Insp., B. & O., Craig Hall
Williams, Morgan E., M. M., P. & R., Sterling
Wyrough, H. M., Gen. For. Shops, Penna.
Young, W. W., M. M., S. P., Chalfonte

Division VI—Purchases and Stores

Dippery, Geo. A., Stores Dept., P. & R.
Eshbach, Harry W., For. St. Dept., Penna.
Farraday, C. L., Spec. Agt. Pur. Dept., Penna.
Good, Herman P., Opp. Cl., Pur. Dept., P. & R.
Kinnear, C. W., Asst. Gen. S. K., Penna., New England
King, Jr., W. H., Asst. V. P., S. A. L., Traymore
Lynch, J. F., S. K., C. of N. J., Brady
Quinty, G. D., Insp., Penna.
Rice, N. M., V. P., Pur. & St., N. Y. N. H. & H.
Sprong, J. White, P. A., D. & H., Marlborough
Starrett, W. A., P. A., C. C. & O., Chalfonte
Taylor, C. R., Catalogue Insp., Penna.
Thomas, P. S., C. C. Stores, Penna.

Special Guests

Ackin, Chas., Haddon Hall
Ackin, Wm., Supt. Trans., R. F. & P., Haddon Hall
Adair, J. G., Mech. Eng., I. C. C., Blackstone
Adams, W. A., Lub. Insp., B. & L. E.
Aiken, Charles D., Haddon Hall
Aiken, Wm. A., Jr., Supt. Trans., R. F. & P., Haddon Hall
Akitt, N. B., Mech. Draft., A. C. L., Breakers
Alexander, Nathaniel, Elec. For., P. & R.
Allmson, Jos. L., Asst. For., P. & R.
Amott, F. R., Insp., L. I.
Applebe, J. M., For., B. & O., Norwood
Appleton, W. H., For. Eng. Ho., Penna.
Ashley, S. F., Draftsman, N. Y. C., Pennhurst
Bacon, D. L., Supt. of Automobile Equip., N. Y. N. H. & H.
Bard, A. R., Asst. For., Penna.
Barr, Dr. Wm. M., Cons. Chem., U. P., Ambassador
Barr, J. W., Asst. C. D., P. & R.
Barr, P. W., Gen. For., Penna.
Bauer, D. M., Draft., P. & R.
Bauer, Robert, Son of M. M., C. C. C. & St. L., Ritz
Beaven, Louis, Mach. Appr., Erie, McGurk's
Bennett, Cranville, Haddon Hall
Bennett, Harry, Haddon Hall
Berger, John, Specl. Eng., N. Y. C.
Besler, Geo. D., Marlborough
Besler, W. J., Marlborough
Blackburn, H. E., Inst. of Appr., Erie, McGurk's
Biemiller, Harry, Asst. M. P. E. E., P. & R., Marlborough
Billig, Chester A., Asst. For., P. & R.
Bickel, Oliver A., Draftsman, P. & R., Stanley
Blair, H. J., Haddon Hall
Blossom, H. F., Ch. Draftsman, N. Y. C., Strand
Blydenburgh, Raymond R., For., Penna.
Boggs, R. W., Elec. Insp., P. & R.
Bond, R. J., Div. Engr., Penna.
Boyer, William E., Draftsman, P. & R., Knickerbocker
Brancher, Peter S., Foundry Manager, P. & R.
Brand, C. L., Gang For., Penna.
Broughton, M. C., Div. Frt. Agt., Penna.
Brown, F. W., Asst. G. M., A. C. L.
Brumbach, Roy S., Electr., Atlantic City R. R.
Bryant, E. B., For. D. L. & W.
Buck, J. H., Eng., Penna., Lexington
Buckley, T. F., For. D. L. & W., New England
Buchmiller, C. C., Asst. For., P. & R., Traymore
Bull, F. R., For., Penna., Delaware House
Bullock, J. W., Insp., B. & O.
Burgdorf, G. B., M. E., N. Y. C.
Burgess, C. H., For., Can. Nat.
Burkley, Harry, Sr., Chelsea
Burns, C. E. Asst. For., Penna.
Callan, Fred. A., Eng., L. V., Craig
Campbell, R. C., Gen. Fgt. Agt., P. & R.
Carney, John E., For. P. & R.
Catheman, H. Y., Asst. Genl. Car Insp., P. & R.
Chester, F. R., Foreman, C. R. R. of N. J., New Brady
Chilcoat, Wm. M., Gen. For., E. B. T., Trexler
Chung, D. M., Works Man., Tientsin-Pukow, Traymore
Clamson, L. C., Ret. Road For., Penna.
Clapp, D. A., T. M., Penna.
Clark, James C., Gen. For., P. & R.
Clay, E., For., C. R. R. of N. J., Sterling
Clouser, H. C., Asst. For., P. & R.
Cokell, Harry A., For., N. Y. N. H. & H., Colonial
Congle, Bertus D., Mach. Shop For., L. V.
Cooke, Jr., Charles B., Pres., West Chester St. Ry.
Coran, E. H., Draftsman, N. Y. C.
Crannell, M., For., N. Y. C., Dennis
Crawford, H. W., Eng. Ho. For., Penna.
Crosbie, Ernest G.
Dailey, J., For., C. of N. J., Brady House
Davis, A. J., Comm. Frt. Agt., West. Md., 31 S. California
Deaney, John, Eng., D. L. & W., St. Charles
Deck, George H., Engineman, P. & R.
Deeter, H. H., Gary 112
Delaney, Thomas, Eng. Ho. For., D. L. & W., Haddon Hall
Dierenderfer, Wm. H., For., P. & R.
Ditmars, L. D., M. P. Insp., L. I., Pine Hall
Dodge, J. W., Supt. Fuel Consvn., I. C., Shelburne
Dollard, T. J., Spec. Eng., C. & O.
Dohn, H. H., Electr., S. A. L., Runnymeade
Donlon, J. J., Penna.
Durborn, I. N., Jr., Draftsman, W. J. & S., Lexington
Duszynski, J., Drop Pit For., C. of N. J., Brady House
Dwyer, W. J., For., Penna.
Eggleston, H. D., R. F. of E., P. & R.
Einwechter, Fred H., Draftsman, B. & O., Louvan
Emmerich, E. E., Ch. Insp. Shop Prac. Bur., B. & O., Brighton
Ems, Jacob, For., D. L. & W., Haddon Hall
English, J. B., For., Penna.
Ernst, W., Asst. Eng. R. S., N. Y. C., Strand
Esterly, William D., Draftsman, P. & R.
Ewing, Geo. N., Mech. Supvr., P. & R.
Fadeley, H. M., Asst. Eng. Ho. For., Penna.
Farrell, John, Gen. For., Penn., Pine Tree Inn
Faust, William, Asst. For. Loco. Shop, P. & R.
Fisk, W. R., Asst. Ch. Clk., W. J. & S., Lexington
Forman, E. T., B. & O.
Free, B. F., For., Penna.
Freedman, E. A., Draftsman, N. Y. C., Traymore
Frentel, W. F., Supvr. Train Light., C. & O., Ambassador
Gall, Howard J., Asst. Rd. For. En., Penna.
Gallagher, Jr., John J., P. & R., Sterling
Gangewere, E. P., Mech. Supvr., P. & R.
Gibson, F. J., Asst. For., C. of N. J., Mason
Gibson, R. H., Asst. Gen. For., N. Y. C., Dennis
Gillespie, Norman, Mach., C. & O., Ambassador
Goda, P. H., Asst. Gen. For., Penna., Princess
Gordon, James K., Asst. For., P. & R.
Graeff, George, Asst. For., P. & R.
Graves, Harold S., Clerk, Penna.
Guthrie, A. I., Clerk, Arlington
Hamilton, C. L., Asst. Supt., Penna.
Hanson, Harry C., Insp. of Locos., I. C. C., Commercial
Hatch, C. E., Asst. Eng. of Tests, N. Y. N. H. & H.
Hawksworth, W. H., For., Penna.
Hembach, Jr., W. F., Kentucky
Hendrickson, Jos. T., Asst. For., P. & R.
Heskett, J. L., Insp., B. & O.
Hill, G. T., Gen. Fgt. Agt., Lake Terminal, Strand
Hill, Howard, Asst. For., P. & R., Stevenson
Hoffman, Geo. C., C. R. R. of N. J.
Hogan, T. R., Asst. Road For., P. & R.
Hughes, J. L., Asst. For., Penna.
Hunter, Allen, De Ville
Hunter, Dial, De Ville
Hurst, Wilfred, S. & T. Spec., N. Y., N. H. & H., Haddon Hall
Immendorf, J. C., For., P. & R.
Isaac, T. C., For., B. & O., Traymore
Ives, Dewitt, Erie, McGurk
Jones, Bert R., Ch. Draftsman, N. Y. N. H. & H., Stevenson
Johnson, Geo. T., Asst. E. E., N. Y. N. H. & H., Marlborough
Johnston, J. W., Ch. Insp., C. N., Princess
Johnson, R. R., Asst. Supvr. R., P. & R.
Jost, J. William, Draft, P. & R.
Jost, J. William, Jr., Draftsman, P. & R.
Kehler, Ralph B., Asst. For., P. & R., Beach View
Keller, E. R., Insp., W. J. & S. R. R.
Kelley, E. J., Ch. Elec. Insp., N. Y. N. H. & H.
Kells, Chas.
Kernan, Monsignor, Strand
Kerns, A. V., Shop Insp., Penna.
Kleber, W., C. of N. J., Brady House
Koch, Geo. B., Genl. For., Penna.
Kocher, W. J., Insp., L. V., Craig Hall
Krieg, Gregory, Asst. For., L. I., Fredonia
Kuehner, K., Draftsman, H. V., Ritz
Laird, Elwood P., P. & R.

Leipold, A. L., Ch. Insp. Elec. Equip., N. Y. N. H. & H.
Leonard, Alfred
Leonard, W. W., Car Lgt. Supvr., B. & O.
Leppington, W., For. Mech. Dept., C. R. R. of N. J., New Brady
Lewis, Charles D., Boiler Insp., P. & R.
Lohman, Charles, For., C. R. R. of N. J., Edison
Lovell, Alfred, Assoc. Mem., Knickerbocker
Lyon, E. V., Draftsman, N. Y. C.
Lyons, G E., For., Penna.
Madeira, Raymond, Asst. For., P. & R.
Malcomson, H. T., G. M., T. H. & B.
Markland, A. R., M. P. Insp., Penna.
Markland, W. C., Gen. Shop Insp., Penna.
Marr, L. K., Supt., Penna.
Marriott, G. A., Office Eng., C. & O.
Marshall, C. V., For., Penna.
Mason, W., For., D. & L. & W.
Mathews, James E., For. Car Insp., P. & R.
Mauger, John T., For., Reading L. P. & R., Terminal
Mays, F. W., Asst. R. F. of E., Penna.
McElree, J. C., E. E., Mo. Pac., Ritz
McCabe, J. J., Ch. Insp., B. & O., Shelburne
McComb, Chas.
McComb, John
McCombs, Thos., Jr., For., Penna.
McCord, Jr., J. P., For. B. M., P. & R.
McCue, Thomas B., Asst. For. B. M., P. & R., Columbus
McCullough, J. R., B. & M., Marlborough
McDowell, H., Gen. For., P. R. T.
McFall, S. K., Mech. Eng., Shipyard, Dennis
McKinnon, H. D., Elec. Insp., I. C.
McQueen, A. B., For., N. Y. C., Brighton
Mears, B. J., Ch. Draftsman, N. Y. C., Continental
Meehan, James R., Eng. App., N. Y. C., Traymore
Neihart, Walter A., Asst. For., P. & R., Somerset
Menanun, C. G., Gang For., Penn.
Metz, Cecil, For., Penna.
Metz, Frank, Asst. For., L. I.
Miller, C. K., N. Y. N. H. & H., Knickerbocker
Mitchell, C. L., Gen. For., B. & M.
Mitchel, Wm. R., Trav. Eng., P. & R.
Moist, H. I., Genl. For., R. F. & P., Marlborough
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Moores, W. Malcolm, Princess
Moores, Robert G., Princess
Morton, Robt. C., Draftsman, B. & O., Louvan
Munson, Floyd, B. M. Appr., Erie, McGurks
Mura, Robert F., For., Car Shop, Atlantic City R. R.
Musselman, S. B., Fireman, Can. Nat., Arlington
Musser, C. W., For., Penna.
Nation, J. D., Asst. Rd. For., of Eng., Penn.
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Nicholas, R. H., Asst. M. M., C. R. R. of N. J.
O'Meara, N. J., Rd. Fore. Elec. Locos., N. Y. N. H. & H., Monticella
O'Neil, James, Mach. Appr., Erie, McGurk's
Ortlieb, J. J., Elec. Supvr., L. I., Knickerbocker
Paine, Donald E., Clk. P. & R.
Palmer, S. I., Asst. R. F. E., Penn., Trenton
Patterson, I. A., Can. Pac., Haddon Hall
Pearson, E. J., Pres., N. Y. N. H. & H., Traymore
Pennell, Stanley B., Asst. Eng., N. Y. C., Traymore
Phillips, G. R., Supvr. Car. Dept., P. & R.
Philips, R. T., Mach. For., Erie, New England
Porter, G. H., For. Elec., P. & R.
Preisser, Harry C., Draftsman, P. & R.
Prettyman, A. J., For. Elect., N. Y. C., Colonial
Ramey, E. E., Fuel Eng., B. & O.
Rapine, Charles W. Mach., P. & R., Princess
Reeve, W. K., City Frt. Agt., N. Y. C., Schlitz
Richard, W., For., C. R. R. of N. J., Brady
Rick, R. C., Eng. Ho. For., Penna.
Riegel, M. S., Son of M. E., D. L. & W., Runnymede
Riegley, Fred, Chalfonte
Riggs, David, Traymore
Roach, J. E., For. Car. Dept., N. Y. C., Colonial
Robinson, J. J., M. M. Ret., So., Dennis
Rumsey, G. M., Dennis
Shadle, Frank S., Elec., P. & R.
Shearer, L. D., Supt. Tel., P. & R.
Smith, C. B., G. F., B. & O.
Stevens, G. E., Supt. Shops, B. & M.
Strunk, A. S., For., P. & R.
Runkle, Chas., Advertising Dept., P. & R.
Rush, Richard, Elect., N. Y. N. H. & H., Osborne
Russell, E. G., P. & R.
Safford, H. T., Trav. Pass. Agt., D. & R. G., Royal Palace
Sanford, H. F., Asst. R. F. of E., Penna.
Saul, Frank, Engr., P. & R., New England
Schell, A. L., Erie, McGurk
Seidell, Frank M., Air Brake Insp., P. & R.
Severn, J. T., Mat. Insp., Penna.
Shank, E. L., Asst. For., P. & R., Stanley
Shields, Geo., Boilermaker, Erie, McGurk
Shulze, Erich, Supt. of Shops, German State Rys., Haddon Hall
Siebert, Frank T., Commercial
Sheehan, J. J., Tool For., N. & W., Marlborough
Small, S. S., Apprentice Inst., Sou., Schlitz
Smith, J. J., Ch. Insp., B. & O., Shelburne
Smith, W. C., Supvr. Pit Insp., N. Y. N. H. & H., Colonial
Smutzler, H. E., Elec., W. J. & S. S.
Steinberg, Fred, Car Shop For., P. & R.
Stroud, John T., Supvr. of Welding, B. & O., Knickerbocker
Soga, M., Ch. Eng., Keihin Rys., Brighton
Spangler, Chas. L., For., P. & R.
Speidel, M. A., M. P. Insp., L. I., Pine Hall
Spence, Chas. H., Draftsman, B. & O., Louvan
Staples, Thos., Ch. Elec. Insp., N. Y. O. & W., Breakers
Stenersen, H. G., Ritz
Stevens, H. V., Asst. Genl. Boiler For., A. T. & S. F., Breakers
Stout, William, Electr., P. & R., Princess
Strunck, Ted, Mach., C. R. R. of N. J.
Stumpf, Carl, For., L. I., Drexler
Sugg, Chas. R., Elec. Eng., H. C. L., Haddon Hall
Sullivan, G. H., Mach., Appr. Erie, McGurk's
Sunderman, H. R., For., H. V., Ritz
Suton, M. F., Loco Shop For., C. R. R. of N. J.
Swenck, John A., Asst. For., P. & R.
Switzer, Wm. G., Elec. Insp., N. Y. C., Traymore
Taylor, Dawson, Erie, McGurk's
Thompson, Fred, Supr. Agt., Penna.
Thompson, John S., Asst. For., P. & R.
Thwaites, D. G., Asst. For., Penna.
Tobias, L. H., Draftsman, P. & R.
Towell, L., Trav. Eng., Penn.
Vedder, Dewight, Mach. App., Erie, McGurk
Walck, W. J., Trav. Car Insp., L. V.
Wall, Geo. W., Elec. For., D. L. & W., Colonial
Ware, C. W., Electr., W. J. & S. S.
Watkins, Thomas, For., P. & R.
Weatherly, A. M., C. C. to M. M., Sou., Ambassador
Weinberg, H. L., Elec. Insp., N. Y. C.
Westbrook, C. G., Mach., Erie, McGurk
Whanger, E. M., Mech. Insp., H. V., Ritz
Wieand, Claude L., Mech. Supr., P. & R.
Wildrik, F. B., Genl. Insp., Erie, Alexandria
Williams, W., For., A. C.
Winters, J. D., Gen. For., B. & O., Dennis
Wood, Prof. A. J., State College, Pa., Morton
Wyld, Stephen H., For., M. P. & R. E. Dept.
Yachmann, Otto, Elec. For., N. Y. O. & W., Breakers
Yarwood, J. G., For., L. I., Pine Hall
Yates, H. Q., For., Penna.
Young, Geo. L., For., P. & R., Shenandoah
Zane, W. H., Air Brake Insp., Penna.
Zielinski, J., C. R. R. of N. J., Ambassador

Executive Committee, R. S. M. A.

Top row, left to right: L. B. Sherman, Charles C. Castle and S. G. Down.
Centre row: John D. Conway (secretary-treasurer), W. K. Krepps, H. E. Daniels, George A. Cooper, George T. Johnson and George W. Denyven.
Bottom row: Charles H. Gayetty, S. H. Campbell, W. H. S. Bateman (vice-president and incoming president), Mayor Bader of Atlantic City, Leroy S. Wright (president), Gilbert E. Ryder (incoming vice-president) and D. L. Eubank

Closing Session of Division V

Report on Utilization of Locomotives Reveals Progress Made in Extension of Runs and Improved Maintenance

THE sixth and final session of the 1926 Mechanical Division Convention was called by Chairman Sillcox at 9.30 Wednesday morning. The entire session was devoted to the presentation and discussion of the Report on Locomotive Utilization, and to the closing exercises.

Report on Utilization of Locomotives

T. B. Hamilton
Chairman

Another progress report is made by this committee which is studying one of the most important problems confronting railway officers. From the point of view of investment alone it is essential to get intensive use of motive power, and then the efficiency of locomotive performance has a vital bearing on that of practically every other unit in the transportation machine. While generally anticipated that this committee will render its final report next year, the problems of locomotive use will never be capable of final solution, and it has been suggested that they deserve the continued attention of a standing committee. The interest already stimulated in locomotive use by the present committee in its investigations on ten roads has undoubtedly been responsible to a considerable degree for the notable improvement in operation shown by the statistics and charts submitted. The constant upward trend of train speed, train load and gross ton-miles per train hour, coupled with a decrease in unit fuel consumption means much in the way of increased net operating income for the railroads and none of these improvements in operating performance would have been possible without better maintained locomotives, more effectively used. More power to the committee in 1926!

The committee prepared and transmitted to member roads each quarter (cumulative) and for the year 1925 compared with 1924 summary of operating statistics for 158 Class I roads. These statistics were worked out on the basis of the number of locomotives in active service and, therefore, feature the showing made by each road in mileage per active locomotive, both freight and passenger. It is gratifying to note that out of 158 roads, 106 increased over 1924 the average miles per month per active locomotive in freight service, and 80 roads increased the mileage per month of their passenger locomotives.

Ten Field Surveys Made

Your committee made field surveys of ten Class I railroads located in various parts of the United States and covering a wide range of operating conditions. These surveys were made to obtain details of conditions, methods followed in the maintenance, assignment and operation of power, dispatching of trains and all available data that would point in any way to a fuller and better utilization of locomotives.

These field surveys firmly impressed upon your committee the importance of adequate enginehouse facilities for the proper repair and prompt handling of locomotives in and out of the terminal. Necessary facilities are indispensable to the prompt and thorough conditioning of locomotives.

A Systematic and Thorough Repair Program

It is of prime importance that turn-around running repairs, certificate repairs and heavy maintenance repairs be done properly, thoroughly and with a minimum of delay, and to this end, careful study of forces, assignment of power to terminals for maintenance, scheduling of repairs and a definite check upon work done be carried out.

It is our observation that for the running maintenance of locomotives, the best results are obtained by the periodic inspection and repair method, that is, at the monthly inspection and repair time, a thorough inspection and repair job be done on the locomotive, putting it in condition to run to the next monthly period with a minimum of terminal delay repairs. At larger terminals these repairs should be handled by a gang especially assigned to this work. After the locomotive has received monthly inspection and proper repairs, it should require only very slight maintenance attention, thereby obtaining the maximum number of hours per day from the locomotive.

Classified or general repairs to locomotives are generally being made on a mileage and condition basis, and on this basis, by reason of extended locomotive runs, class repairs will come at a shorter period of time, thereby putting the locomotive into the shop where important or extensive repair work can be made with less loss of time to the locomotive, which will result in an improved condi-

tion of the locomotive during its term of service. As a result of the above program, it is possible on some roads or under some operating conditions to increase the mileage between class repair periods.

Roadway Facilities—Dispatching Locomotives and Trains

It is also important that roadway facilities, such as lap sidings, remote control switches, location of water and fuel facilities on line of road, location of yards with reference to maintenance facilities, efficient blocking of trains, proper length of sidings, double track, facing point cross-overs, adequate signaling, etc., be given careful consideration and be provided where possible, as these facilities have a decided influence on the number of locomotive hours required to move a train from the initial to the final terminal.

Close co-operation must be obtained between transportation and mechanical department forces, so that delays to engines at terminals may be reduced to a minimum. The scheduling of trains at

Trend of Principal Operation Units—All Class I Roads

times of day when the least interference will be encountered is a matter of importance. The dispatching of trains enroute over the division must be given careful thought to avoid every unnecessary stop. Telephone dispatching, the elimination of as many train orders as possible, in fact every efficient dispatching means known should be employed to reduce stops and relays to trains enroute.

As far as possible locomotives made ready at terminals and the dispatching of trains from the terminals should be anticipated, in order to reduce to a minimum the time between repairs are complete and time of leaving the terminal.

The anticipation of power is of great importance, both to the maintenance forces in scheduling repair work and to the transportation department in scheduling departure of trains.

Extending Locomotive Runs

During the past year, we find a great deal of thought and attention being directed by many roads to the matter of extending locomotive runs, both passenger and freight over two or more engine crew divisions. The data we have obtained upon existing extending runs indicate, beyond any doubt, a very fertile field for economies of operation and increased capacity for a given number of motive power units. These economies result from the elimination of small intermediate terminals, made possible by running engines by them, the waste of fuel encountered by cutting off locomotives, and the maintenance and engine house operating costs at such terminals. The extending of locomotive runs has the effect of reducing the number of locomotives required to handle a given business and, therefore, increases the capacity of the road to handle a greater volume of business with the same number of power units. Locomotives on extended runs are kept in active service a greater number of hours per day without a corresponding increase in the number of hours out of service for maintenance. Through extending the runs, the assigned mileage between class repairs will be obtained in a much shorter period, which results in a greater proportion of the maintenance cost being thrown into general or class repairs, eliminating to a large degree minor running maintenance costs, which do little to maintain the condition of the power. It is our observation that the governing factor in extending locomotive runs over two or more divisions is almost solely a question of proper maintenance at the dispatching terminal and proper care in handling and operating engines enroute, rather than to any fuel, water or physical characteristics of the road.

The advantages to be obtained from extended locomotive runs are beyond any question sufficient to justify careful study of roadway facilities and to change the location of water and coaling facilities, ash pits, etc., or to install new facilities to permit engines running through. We have definite data covering extended locomotive runs that have been put into effect showing as much as much as 100 per cent increase in the number of miles per locomotive per month on a specific group of runs and instances of where from 9,000 to 12,000 miles per month per active locomotive are being made in passenger service and from 5,000 to 6,000 miles per month per active locomotive in freight service. These figures apply to heavy grade territories, bad water and low grade fuel districts even to a greater extent than to territories with better fuel and water conditions, and were obtained with heavy, modern types of power.

Your committee has endeavored to get specific information on enconomies effected by different carriers due to extending locomotive runs over more than one engine crew district. Four railroads have submitted statements showing that on a very conservative basis of comparison their annual savings from this practice are $1,047,70.

Switching Power—Elimination of Unnecessary Power

An important saving in power and cost of maintenance and operation may be made in many instances by a careful analysis of the yard switching operation. On our field surveys, this is impressed upon us by instances of excessive number of locomotives being used for the number of yard tricks required. A study of yard operations will, undoubtedly, in many instances, reveal possibilities of working yard locomotives two or three continuous 8-hr. tricks before being turned in for inspection and repairs where locomotives are now being used for one trick.

Operating officers should watch carefully the daily power requirements and remove from service engines in good condition for storage as any decrease in the business warrants and, furthermore, eliminate to the greatest degree possible obsolete or unfit locomotives from their assignment, realizing that the best results follow from having the minimum of power actually required in service. This program will give the maximum mileage and service from the modern and more efficient locomotives.

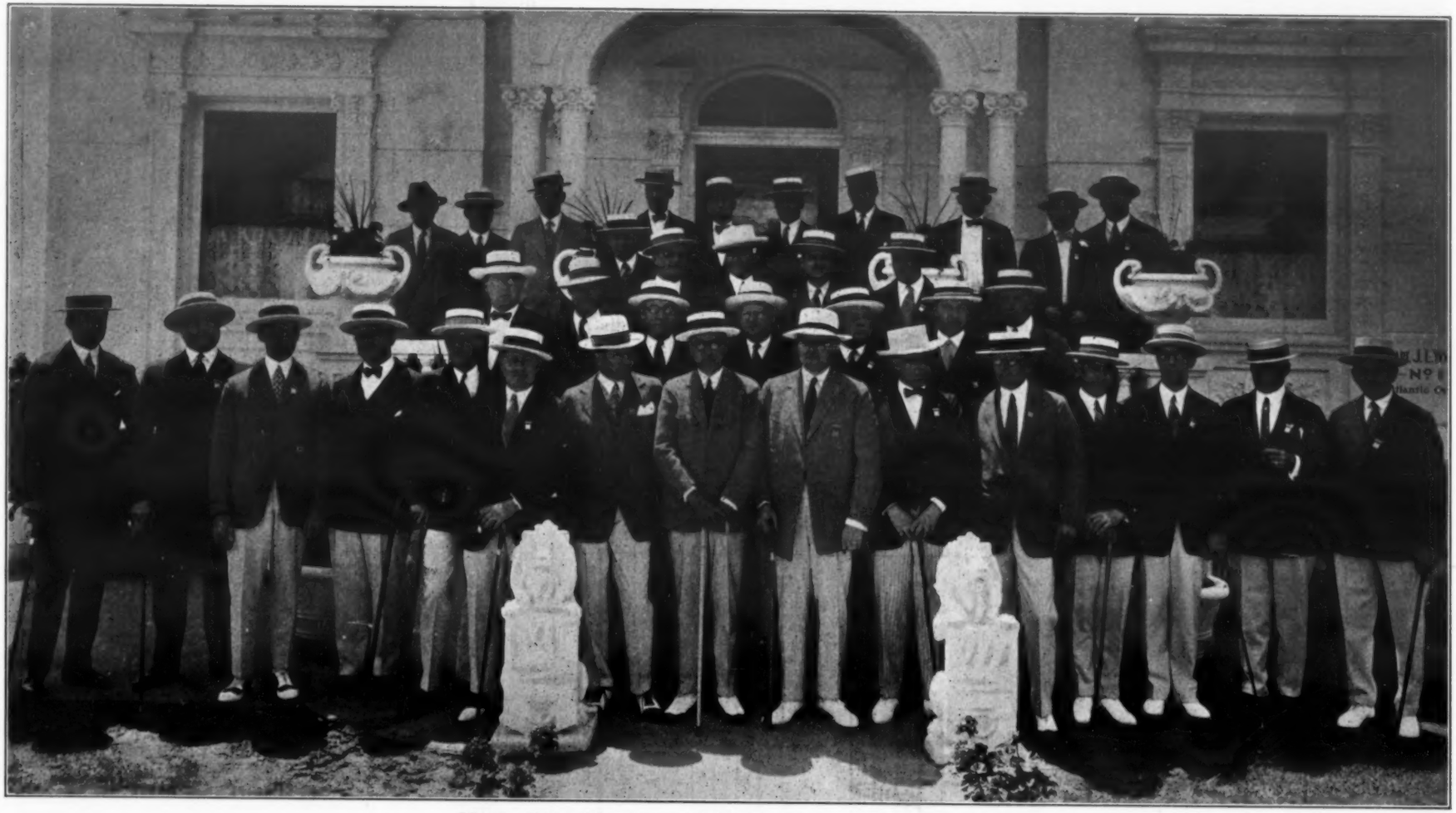
Water—Fuel

Proper consideration should be given to the quality of water for locomotive boilers, recognizing that generally the quality of water on a road or division is determined by the natural qualities of the water available in that territory. The committee feels that the matter of water treatment should be carefully considered and that proper treatment should be given the boiler water, as this has a most important bearing upon locomotive maintenance and hours out of service, and almost any expense required to obtain the best boiler water for locomotive use is justified. The extending of locomotive runs over two or more districts where bad water conditions exist has been found to neutralize to a great extent the trouble experienced with boilers foaming, pitting, scale, etc.

It is the thought of the committee that better performance and operation can be obtained from locomotives by maintaining a uniform grade of fuel for a division or district, or, if possible, for the entire road, rather than mixing various grades and qualities of coal indiscriminately. While the quality of the fuel may be low grade, better results can be obtained by furnishing a uniform grade of coal and providing suitable grates and adjusting draft appliances of the locomotives to use this coal rather than by using various grades and qualities of coals in one territory.

Analysis of Operations on Individual Railroads

It should be recognized that each individual railroad has its own peculiar problems and conditions and that a careful analysis and study of all operating conditions will need to be made on each road



Most of the Members of the Entertainment Committee

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Second row, left to right: L. K. Momson, J. L. Rowe, A. G. Johnson, O. C. Hayward, F. E. Symons, G. L. Gordon and R. W. Williams.
Third row, left to right: Langley Ingraham, W. J. Hyman, J. P. Bourke, A. D. Morrow and Irving H. Jones.
Top row, left to right: S. L. Bateman, L. B. Rhodes, W. G. Krauser, F. W. Venton, H. A. Pastre, J. A. Renton, L. J. McCombs, C. L. Brown, L. R. Pyle and S. B. Wright, Jr.

when considering the extension of locomotive runs or increasing the utilization of locomotives. No set rules or plans can be followed alike by all individual railroads. It is eminently important in setting up extended locomotive runs or in the revision of power assignment with a view of increasing hours of service of locomotives, that careful and adequate supervision be given the matter to insure the success of their plans. Usually opposition is encountered from many sources and angles when extending locomotive runs or re-assignment of power with a view of increasing the hours of service and any plan that is not carefully worked out, thoroughly supervised, and all necessary detail provisions made, is ordinarily certain to be a failure where there is every reason for it to have been a success.

In many instances roadway restrictions; such as track, bridges, etc., interfere seriously with the extension of locomotive runs or the fullest use of the heavier more modern types of locomotives. In many instances the removal of such restrictions would permit the heavier modern locomotives to operate over two or more crew divisions with the attendant increase in train loading and economies of transportation that are now impossible by reason of such restrictions.

Train Loading and Tonnage Rating

Where possible, tonnage ratings for locomotives should be established by the use of a dynamometer car, and where not, by careful practical tests. For the best results it is, of course, essential that locomotives be loaded to the maximum rating permitted by grades, weather conditions, etc., the character of traffic and roadway facilities, and the character of road usually determining tonnage ratings. Tonnage ratings on arranged service or high class fast schedule time freights must not, of course, be increased to the point where the required movement and time cannot be made; but, on the other hand, careful attention to providing the maximum train load possible is a very essential matter to transportation economy and the fullest use of the locomotive.

Study of Locomotive Designs

The design of a locomotive with all its detail parts frequently has a very decided bearing upon the possibilities of its utilization. Details of construction of both boiler, machinery, and all appurtenances should be carefully designed and the best of material used with the thought of eliminating to the greatest degree possible running repair costs and delays at terminals. In many instances a decided improvement in the condition of power with resultant lower maintenance costs, attendant delays at terminals, and a reduction of engine failures can be obtained by changing the design of details or by the application of additions and betterments to locomotives in the replacement of old parts with new materials and design. Along these lines floating bushings, solid front end main rod brasses, improved cylinder packing rings, larger capacity locomotive tenders, etc., have contributed to greater utilization of locomotives.

The report of this committee at last year's convention featured 10 items dealing with utilization of locomotives. It is desired to emphasize the prime importance of these principles in securing the maximum service from locomotives. The roads that have operated extended locomotive runs are continuing to improve their utilization of locomotives by more thorough application of these principles which indicates that the maximum of locomotive utilization has not been reached.

Exhibit I—Detail Operating Statistics, 1924-25

Operating statistics are shown in some detail for the larger roads for both freight and passenger service in the tables. Operations in general show a considerable improvement when compared with the previous year, most of the larger roads showing a substantial increase in train loading, gross ton-miles per train hour, and gross ton-miles per locomotive per month.

The chart indicates the progress made by Class I railways during the past four years in increasing train speed, train loading, and gross ton-miles per train hour; this latter item, better than any other, indicates the general improvement in operations. The chart also brings before you clearly the remarkable showing being made by Class I railways in their efforts to reduce fuel consumption. During the year 1925 an average of 158.9 lb. of fuel was required to haul one thousand tons of freight and equipment, excluding locomotive and tender, a distance of one mile, as against an average of 169.9 lb. for the year 1924. In passenger service an average of 16.10 lb. of fuel was required to haul a passenger train car a distance of one mile, as against 16.96 lb. for the year 1924. Had the 1924 unit consumption figures obtained during 1925, Class I railways would have required an additional 5,596,000 tons of coal in freight service and an additional 1,606,000 tons of coal in passenger service, to handle the volume of business offered, making an enormous total of 7,202,000 tons of coal saved in road train service; this being exclusive of saving effected in yard service, station service, etc. Your attention is called to the following:

New England Region

The average mileage per month per total freight locomotive for roads comprising this group shows a small increase; gross ton-miles per total locomotive per month increased 7.4 per cent; gross tons per train increased 6.1 per cent, train speed increased 2.6 per cent; gross ton-miles per train hour increased 8.2 per cent; pounds of coal per 1,000 gross ton-miles decreased 6.5 per cent; gross ton-miles handled increased 3.6 per cent.

Great Lakes Region

The average mileage per month per total freight locomotive for roads in this group increased 4.1 per cent; gross ton-miles per month per total locomotive increased 7.1 per cent; train speed increased 2.6 per cent; gross tons per train increased 3.3 per cent; gross ton-miles per train hour increased 6.4 per cent; pounds of coal per 1,000 gross ton-miles decreased 5.6 per cent; gross ton-miles handled increased 4.0 per cent.

Central Eastern Region

The average mileage per month per total freight locomotive for roads in this group increased 7.7 per cent; gross ton-miles per total locomotive per month increased 12.0 per cent; train speed increased 4.0 per cent; gross tons per train increased 4.9 per cent; gross ton-miles per train hour increased 8.7 per cent; pounds of coal per 1,000 gross ton-miles decreased 6.4 per cent; gross ton-miles handled increased 8.8 per cent.

Pocahontas Region

Roads comprising this group had the largest increase in tonnage handled and effected the greatest improvement in their train operations. Miles per total freight locomotive per month increased 5.9 per cent; gross ton-miles per total locomotive per month increased 15.6 per cent; train speed increased 4.8 per cent; gross tons per train increased 8.2 per cent; gross ton-miles per train hour increased 13.7 per cent; pounds of coal per 1,000 gross ton-miles decreased 12.0 per cent; gross ton-miles handled increased 16.1 per cent.

Southern Region

Miles per month per total locomotive for roads in this group increased 8.0 per cent; gross ton-miles per month per total locomotive increased 12.1 per cent; gross tons per train increased 4.4 per cent; train speed decreased 0.8 per cent; gross ton-miles per train hour increased 4.2 per cent; cars per train increased 3.8 per cent; pounds of coal per 1,000 gross ton-miles decreased 4.5 per cent; gross ton-miles for the period increased 10.7 per cent.

Northwestern Region

The average mileage per month per total freight locomotive for the roads in this group increased 3.1 per cent; gross ton-miles per total locomotive per month increased 8.4 per cent; gross tons per train increased 6.3 per cent; train speed increased 2.5 per cent; cars per train increased 6.5 per cent; gross ton-miles per train hour increased 8.7 per cent; pounds of coal per 1,000 gross ton-miles decreased 5.6 per cent; gross ton-miles for the year increased 4.5 per cent.

Central Western Region

The average mileage per month per total freight locomotive for the roads comprising this group increased 2.6 per cent; gross ton-miles per total locomotive per month increased 6.4 per cent; gross tons per train increased 5.2 per cent; train speed increased 1.6 per cent; cars per train increased 5.4 per cent; gross ton-miles per train hour increased 7.4 per cent; pounds of coal per 1,000 gross ton-miles decreased 7.1 per cent; gross ton-miles for the year increased 5.0 per cent.

Southwestern Region

The average mileage per month per total freight locomotive for the roads comprising this group increased 4.9 per cent; gross ton-miles per total locomotive per month increased 10.5 per cent; gross tons per train increased 5.7 per cent; train speed increased 5.0 per cent; cars per train increased 6.9 per cent; gross ton-miles per train hour increased 10.7 per cent; pounds of coal per 1,000

gross ton-miles decreased 7.8 per cent; gross ton-miles for the year increased 8.4 per cent.

This report was signed by the joint committee on Utilization of Locomotives made up of members representing the operating division: T. B. Hamilton, vice-president and general manager, Western Region, Pennsylvania System; J. T. Gillick, chief operating officer, Chicago, Milwaukee & St. Paul; A. E. Ruffer, transportation manager, Erie.

Representing the mechanical division: W. H. Flynn, superintendent motive power, New York Central; W. H. Fetner, chief mechanical officer, Missouri Pacific; O. S. Jackson, superintendent motive power and machinery, Union Pacific.

Discussion

Samuel Vauclain (Baldwin Loco. Wks.): The paper that has just been read was most interesting to the builder, because it is a complete confirmation of that which builders have been advocating for several years, namely, the better utilization of locomotives. They have also been working to this end by the application of everything in the construction of the locomotive that will make it more durable, more lasting, and less liable to delay.

Of course, long-distance running, as it is practiced today, would probably have been impossible 20 years ago with the method of lubrication that was then employed, the driving mechanism and the valve mechanism of the locomotives then used, the driving box construction, the shoe and brake construction; in fact, by almost every detail, one by one, the locomotive is, as we now have it today, a long-distance machine, perfectly reliable. Its proper use as a long-distance machine will certainly result in great economy.

Of course, in long-distance runs there is not only the economy effected in the handling of the engine itself, but the doing away with terminals is where much greater economy comes in because the roundhouse facilities at various points can be eliminated entirely.

The locomotive is under most constant pressure all the time. The boiler will be more easily maintained by being under a uniform pressure for a longer period of its life, or between shoppings, and staybolt repairs will be less. In fact, there is everything to be gained by working out a satisfactory system of operating locomotives for the longest possible distance without turning them.

There is an idea in many places, not only in this country but abroad, that something should be invented, something should be devised, that would supersede the steam locomotive. It is my opinion, after a thorough examination of everything that has been done, not only in this country but abroad, that we can save more money in the operation of our railroads by giving our attention more closely to the development of the steam locomotive. I assure you that you are going to have it with you not only the rest of your lives, but that your children will have to deal with this means of locomotion.

Modern steam locomotives today are an indication of the advances that have been made within the last 10 years or even since the first of the year. We have made very great progress. And the builder has been endeavoring to eliminate certain things which are very necessary to be eliminated if we are going to have any great advance in the performance of our locomotives.

Fortunately, we in this country can use locomotives of large sizes and, therefore, we have an opportunity to exercise our ingenuity and our inventive power that we would not have if we were restricted to the limitations of locomotives abroad.

You will have noticed here in the exhibit which the Baldwin Locomotive Company has, a locomotive No. 60,000. This locomotive was built to determine whether it would be possible to make any great increase in the economy of the locomotive, and also in the avoidance of those things which take locomotives out of the service under the laws which we operate under today. The principal thing which we desired to do away with was the staybolt in the firebox, to make a locomotive with a firebox that had absolutely no staybolts in it at all. Of course, this is hard on the staybolt manufacturers, ourselves included, but nevertheless, if locomotives can be constructed of the enormous capacities which are now being used, it is going to be, in our judgment, a great stride in the advance of the science of locomotive building. We also, you will have noticed, have undertaken to compound the three-cylinder type of engine. If we are going to have fuller benefits of the advantages of the three-cylinder engine, we should have further advantages in it that would pay for the extra cost of maintenance of the three-cylinder engine, and there is no reason why we should not compound these engines if we have to use an inside cylinder and crank axle, and we should have the advantages from compounding. In order to derive an advantage in compounding, in the present state of the art, it is necessary to have a still higher pressure than that which we feel we should not exceed in the construction of the staybolt firebox, namely, 250 lb.

So this locomotive is constructed with a pressure of 350 lb. It is possible to go to still higher pressure. Mr. Loree is now having a locomotive built by the American Locomotive Company which he tells me will carry 400 lb. In Europe, a locomotive has been built which carries, I think, something over 800 lb. But while these pressures seem high to us today they will not seem high to us three or four years from now.

If you go back over the records of the Master Mechanics' Association, you will find the most serious discussion when we undertook to increase boiler pressures from 120 lb. to 130 lb. When we finally got it to 130 lb. someone undertook to raise it to 140 lb. and it was looked upon as a crime and that it was a dangerous thing to do.

Suddenly somebody applied 150 lb. and finally the standard for single expansion engines was raised to 160 lb. Then the compound man came along and he wanted to raise the pressure to 180 lb. Well, the single expansion man said: "There is no reason why we should not make the cylinders smaller and use 180 lb. We can get just as much in the performance of the engine as the compound man will get." The compound man building at 180 lb. pressure was then subjected to an advance to 200 lb. pressure being advocated by the single expansion engine. I think the first case of this kind was on the C. M. & St. P., and the results were most satisfactory but it immediately called for pressures of 200 lb. for all compound locomotives.

We ran along at that for a few years. The next step up was 205 lb., which I think was on the Penna. Then somebody thought about exceeding that. It went to 210 lb. Then that got along as far as 240 lb. and now we have many locomotives under construction carrying 250 lb.

The use of the superheater has also enabled us to do away with many contraptions that we used to use on locomotives in endeavoring to have fuel and now we have another idea which is being put in force rapidly. I think the pioneer of this type of engine is the Pennsylvania, that is, a single-expansion articulated locomotive instead of a Mallet compound articulated locomotive.

These engines now are becoming popular and they are being found most advantageous and economical. In fact, comparative tests between articulated engines of this kind as compared with Mallet articulated engines show results which are so astonishing that those who have made the change over hesitate to talk about them for fear they will not be believed. The secret of it, however, is that in going down grades the Mallet compound burns almost as much coal as it does in pulling the train up the hill. It is

economical while it is working, whereas, the single-expansion engine is economical under both conditions. In addition to that, this engine is mobile. It makes higher speeds, can run with the same ease, the same facility and the same speed that the ordinary locomotive having the same diameter of wheels can operate.

The future of the steam locomotive in America is unknown. To my mind we have really only got started in building high-grade, high-duty steam locomotives. We are in the same condition now that our stationary friends were a few years ago. Manufacturers used to furnish their own power, put in stationary engines, compound engines to drive generators to furnish their own electric power. That day is passed. No one can afford to manufacture his own power today because he can buy it for almost half the cost from these large utility companies. This consumption has saved three to four pounds of coal per horsepower for stationary purposes and is now down to about one pound of coal per kilowatt.

W. H. Winterrowd (Lima Loco. Wks.): In looking over the report, I was particularly impressed with the series of graphs that you will find. The graphs present a remarkable story. When one stops to consider the railway mileage of this country, the volume of business handled, the equipment, the facilities, the problems of operation, the vast number of men involved, and the organization necessary for the accomplishment, the results are impressive. These results clearly indicate the increased efficiency of our railways and emphasize the value of the systematic and constructive effort of the American Railway Association.

May I call attention to a few points that I think merit attention and emphasis.

Switching Power: In the railway yards of this country there are many switch engines that were once road engines. Maximum efficiency and economy are not possible in switching service with obsolete road power. The greatest speed of operation combined with maximum power and economy is only possible with locomotives designed for this particular service. Modern switching power makes possible the best operation with the fewest number of engines.

Under the item of fuel, I would like to mention a point that I have thought of for quite a number of years and I mentioned it in a paper that I read before this Association two years ago. Caution should be taken in the use of the term "pounds of coal per thousand gross ton miles." Its use in the graph is proper in the sense that it reflects the general trend throughout the country. Its use is also permissible on individual roads where conditions of operation are identical. But there seems to be a tendency for different roads to compare their fuel performance on this basis without taking into account the great differences in quality of fuel, the character and condition of equipment, as well as the characteristics of gradient and operation and nature of traffic.

There is real need for a generally accepted measure of work which will enable individual roads to make comparisons on a common basis involving all controlling factors. A committee of this Division could well give this major attention.

Then in the last item on the subject of locomotive designs, I will emphasize again one of the points that Mr. Vauclain emphasized so plainly. The increase in gross tons per train hour and the decrease in lb. of coal consumed per 1,000 gross ton miles, reflects in part the introduction and use, during the past four or five years, of locomotives capable of producing increased power with more economical fuel performances.

These locomotives were constructed with the power plant idea in mind and with the object of moving freight and passengers from one point to another with maximum practical speed and maximum fuel economy. It is significant that this trend is being recognized. An editorial in the *Daily Railway Age* of yesterday expresses this in the following clear and logical manner.

"That the conception of what is a locomotive, is progressing can hardly be doubted after one has inspected the steam locomotives on the track exhibit. It has not been long since the locomotive was regarded as so many tons of metal which were to be secured at as low a price per ton as possible. While, no doubt, such ideas still pertain in some instances, there is marked evidence of a growing appreciation of the fact that the locomotive should be regarded as a power plant and purchased on much the same fundamental basis as would obtain in the case of a central station power plant.

Recent developments indicate that the growth of this new conception is accelerating. At the outset the expression of the idea was evidenced in the addition of the capacity and efficiency increasing devices, which have become thoroughly established during the past twenty years, to locomotives of strictly conventional fundamental design. With a growth of the idea, there has come about a marked change in the treatment of the locomotive itself, as distinguished from the devices which have effected such marked increases in capacity and efficiency. We now see a rapidly growing willingness to forget the conventionalities of locomotive form and proportions, or at least to submit them to a critical examination in which good reasons for their retention must appear if retained."

A. I. Lipetz (A. L. Co.): The ultimate object of the railroad is of course cheap transportation and the amount of cost of one net ton mile, because that is the unit from which they get the revenue. As far as the mechanical department is concerned, the object is the cheap gross ton mile and this depends very much upon the power of the locomotive, and not on account of the economy of the locomotive itself. The power as distinguished from the economy, being equally economical, one having only one-half of the power as compared with the other, would be less economical than the other, for the mechanical department, because the amount of fuel per ton mile drops with the haulage capacity of the locomotive.

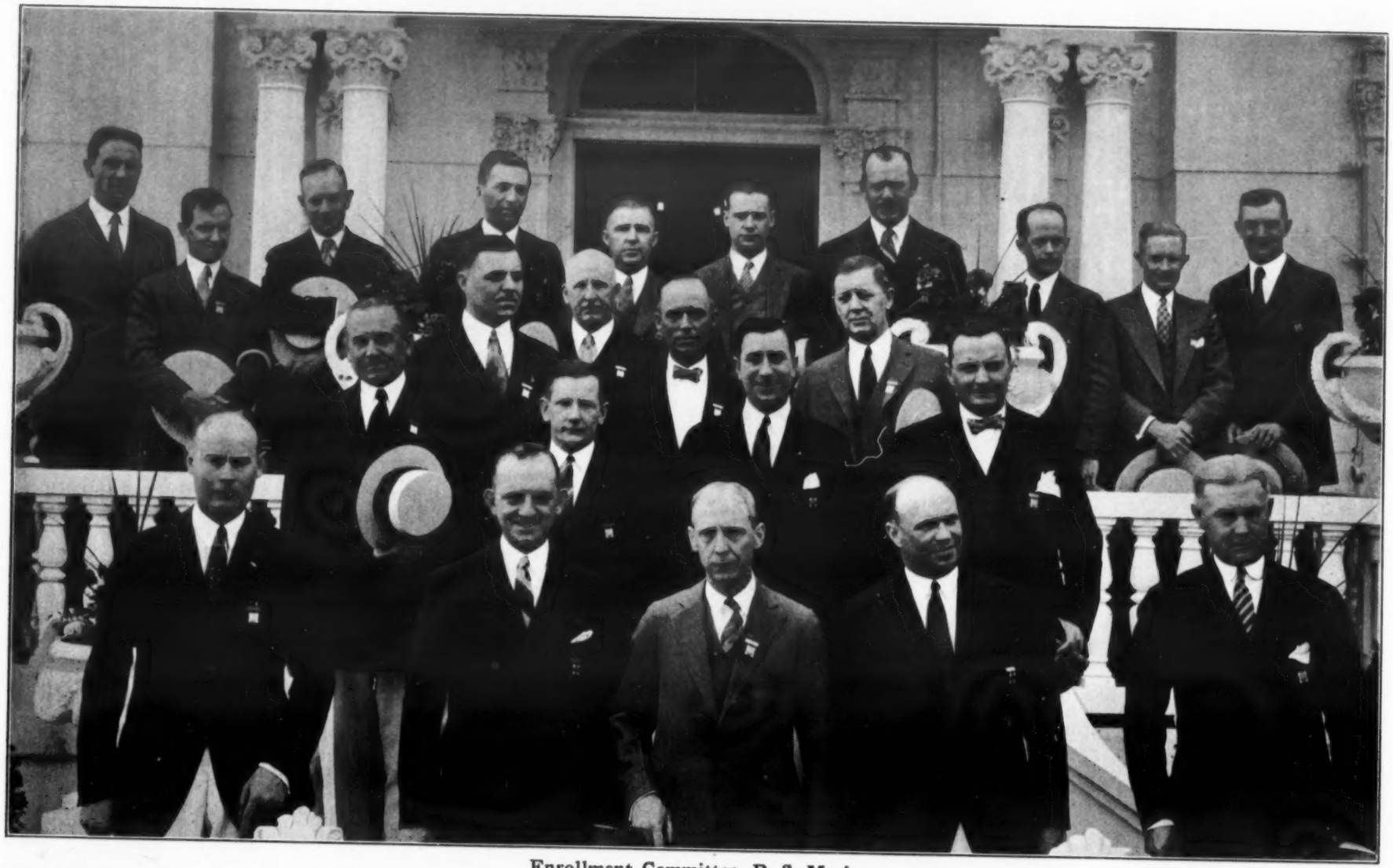
The astonishing figures which we heard in this report, as to the economy obtained within the last year, is no doubt due to the question of the locomotive as a mechanism but mostly through the sizes of the machines which are used now as compared with those which were in use years ago.

The object of the railroad operator is of course to look after the power and upon the big economy which he can get from using more modern and more suitable power for his railroad condition. The object of the builder is to get the most economical engine within the limits which are permitted by the railroad operator. The latter is the point on which, of course, I can say something.

If we had a retrospective look on what was accomplished last year, as regards economy in the locomotive, it can be reduced only to seven points, the most important of which will be the better utilization of steam in locomotive cylinders. This is the same as to say to use the steam in the cylinders more expansively. I think there are many locomotives in this country even now which are using cut-offs, on grades, approaching 85 to 90 per cent. The locomotives which have been recently built, with so-called limited cut-offs, permit the use of the smaller cut-offs and of larger expansion of steam.

Now, the means which will bring us to such results will be to raise the pressure of the steam, because then we can use the steam more expansively, and shorter cut-offs.

It must be remembered, however, that the advantages which go up with the raising of the pressure are not so rapid with high pressure as with low pressure. Never-



Enrollment Committee, R. S. M. A.

Bottom row, left to right: H. V. McKedy, J. E. Brown (vice-chairman), Arthur Haller (chairman), F. L. Johnson and W. R. Van Steenburgh. Second row: F. E. Dodson, P. B. Miller, F. C. Koch and M. K. Tate. Third row: P. E. Raymond, A. N. Willsie, A. B. Edge and W. H. Dickinson. Top row: John E. Leonard, Edward Wray, H. L. Burrhus, H. K. Williams, T. F. Sheridan, E. E. Thulin, R. J. Himmelright, H. H. Melville, J. A. Walsh and A. D. Stuver

theless, the advantages are sufficient to justify the attempts which are now being made in raising the pressure in locomotive boilers.

In order to use the steam more expansively it is also advantageous to use a larger volume of cylinders. That is being done in the big two-cylinder locomotives, which permit the limited cut-off; also in multi-cylinder locomotives where a larger volume is obtained by increasing the number of cylinders and also by compounding, which gives better expansion.

The experience which this country had with compounded locomotives in the past should not be considered a handicap to the present development of the compound locomotive. The compound locomotive may be successful now notwithstanding the fact that at the time when coal was cheap it was a complication not justified by the saving in fuel. Even if, as some people think, compounded engines should not be a success, we still have the benefit of raising the pressure.

I would like to accentuate the benefit of the higher superheating which sometimes we overlook when we talk about the other developments in locomotive design. When we raise the pressure of the steam we raise the temperature of the superheated steam, but we do not raise the ultimate temperature of the superheated steam for various reasons. If we could, parallel to the raising of the temperature of the superheated steam in accordance with the raising the pressure, also get a higher superheat, say, 850 instead of 700, those 150 deg. of temperature would give us much more benefit than many hundreds of pounds which we can get in pressure. If we could devise methods and lubricants to stand the high temperatures the development would have a great bearing upon the designing of locomotives.

Another point the importance of which is not often recognized, is proper counterbalancing. It was with great interest that I read in the report of the committee on Locomotive Design and Construction, that the desired effect, a reduction of stress, may also be accomplished by a counterbalance of these overhanging weights of the crankpins and rods by applying to the opposite main wheel a weight whose centrifugal moment is equal and opposite to the moment of the overhanging weights above mentioned. The latter method has the advantage of accomplishing the desired results with a minimum increase in total weight. However, it is more complicated calculation for the builder and also a more complicated manufacturing process, but when the counterbalancing has been offset in the wheels there is no difference whether it is offset or at a certain angle or whether it is larger or smaller, except only that there is a lead counterbalance to be looked after in shops when the engine is being overhauled. The only difference would be that he would have other weights and a certain angle to look after. I do not think that this is any complication compared to the advantages.

The proper counterbalancing method is an advantage which, to my surprise, was little used in this country. It is being used more extensively now but it was always used in Europe because it gave a much better counterbalance to the whole engine, decreased the stress in the tracks, increased the mechanical efficiency of the locomotive, and permits a much higher static load.

Now, a few words about the possibility of replacing the steam locomotive or improving it. There are many skeptical opinions about that. The steam locomotive has been so improved in the past that people have sufficient grounds to be skeptical. When we compare locomotives of the present time with those built only 20 years ago, they are two and three times as powerful and consume only about one-half of the coal that was consumed formerly. But the internal combustion engine gives such a saving and is such an economical prime mover as compared with the steam engine that it is worth while to develop it.

If we built a three-cylinder single expansion locomotive with the idea of obtaining one-half per cent more efficiency under the 7½ to 8 per cent efficiency for the whole locomotive, and compare that with the 20 or 28 per cent efficiency which can be obtained from a Diesel locomotive, the possibilities are so vast and so attractive that we cannot help but think that if we would not develop this it would be of great significance to civilization and the transportation problem.

The 20 per cent which I have cited is not a theoretical figure. It is a figure actually obtained on several locomotives which have been built within the last several years. The Diesel locomotive has many disadvantages as compared with the present-day locomotive, which has a history of 100 years, but we should not compare a little child with a grown-up person, and disadvantages and handicaps to the present Diesel locomotive may be overcome within a period of 20 or 25 years.

The Diesel engine itself is now 30 years old, but it has been developed only as a commercial product possibly within the last 10 years. This country was slow in adopting the Diesel engine for marine purposes. It took over 25 years to convince people that this engine used for stationary purposes could be rebuilt and remodeled in such a way as to be also applicable for marine purposes.

The same thing should happen to locomotives. Those which are at present being built are a little crude. They are a combination of Diesel engines and electric transmission and running gear of the steam locomotive, but this combination can no doubt be developed and perfected and finally you can get a locomotive which will satisfy requirements.

For switching purposes a Diesel locomotive has already proved advantageous and shown an economic consumption of fuel, which in dollars and cents is only one-eighth of that of the steam locomotive. The switching locomotive wastes much fuel, not when it pulls trains, but when it is standing, either idle or waiting, so-called "stand-by losses." This is eliminated in the Diesel locomotive. A Diesel road locomotive may prove to be not quite as economical in fuel, possibly over one-quarter of the fuel consumption of a steam locomotive while the switching locomotive may give a figure of one-eighth or one-tenth.

The present development of the Diesel locomotive is the accomplishment of only a few years, how much more can we accomplish if we develop Diesel locomotives for road service. Whether the Diesel locomotive will eventually use electric transmission or some other drive, is what the builders are trying to find out.

A. G. Pack (I. C. C.): It matters not how well you may design, construct and build your locomotives, if you do not have proper facilities for maintaining them and do not maintain them so as to fully utilize them in the most economical way, your efforts have come to naught. You must have shop facilities, you must have suitable water conditions, you must have tools if you are going to maintain your locomotives and going to get the maximum efficiency from them.

I want you to understand that in my efforts I desire to cooperate with you in bringing about a better motive power condition and a better operating condition on the railroads. I want you to cooperate with me. Through cooperation we obtain the best results with the least friction, and where you reduce friction you get a better rolling machine.

W. H. Flynn (N. Y. C.): It is well known and conceded that locomotives cannot be kept in service and moving constantly 24 hours every day. Maintenance and operating conditions make this impossible, but as locomo-

tives when idle are not pulling cars and the prime purpose for which they are built is that of pulling cars, it is necessary in furnishing adequate transportation in conjunction with obtaining economical operation to reduce the idle time of locomotives in service to that which is unavoidable.

Intensive locomotive utilization is not a fad or passing fancy—it is an economic necessity. The investment in locomotives is large and increasing with their development and this emphasizes the necessity of having them available to perform actual transportation service the maximum percentage of time possible to obtain, and to make the maximum use of them during their period of availability.

The committee in its report has briefly presented suggestions and an outline of practices and methods, which have proved successful in obtaining more and better service from locomotives, and which at the same time have resulted in effecting substantial economies.

Each item can well be considered carefully, and while their relative importance may vary on different railroads, a study should be made by each railroad company to determine wherein any or all of the items referred to in the report can be applied to the end that maximum utilization of its locomotives may be assured.

C. F. Giles (L. & N.): The several operating statistics reports of Class I railroads which have been issued by the Joint Committee on Utilization of Locomotives showing, among other items, the mileage performance of active locomotives, indicate a radical variation in this factor as between various roads. For example; the last report issued by the committee, dated October 9, 1925, covering the first six months of that year, shows that on one of the large railroads the average miles per active freight locomotive per month is 3,387, while this same factor on another large railroad is but 1,528, a difference of 1,859 miles per active locomotive per month.

The mileage figures in this example were purposely selected to stress the great difference in this factor that actually exists as between the larger railroads which obtain the maximum mileage from their locomotives and the road to which the minimum figure applies. Quite a few roads obtain in excess of an average of 3,000 miles per month from the active locomotives, one reaching the maximum of 4,182 miles, while a greater number of roads obtain less than 2,000 miles per month, running say between 1,500 and 2,000 miles per month, and the remainder, constituting a considerable number of roads, obtain between 2,000 and 3,000 miles per active locomotive per month.

It appears that if one road is able to attain a relatively great amount of mileage per locomotive, that other roads should likewise be able to accomplish approximately the same results. At least there appears to be no serious obstacle that would prevent a substantial improvement in that respect on those roads where a low record obtains.

A low mileage figure per active locomotive reflects a corresponding increase in unproductive time at terminals, and since locomotives represent such a large capital expenditure it naturally follows that an intensive utilization of same is highly desirable and advantageous.

In my opinion the data shown in the reports submitted by this committee is very helpful and valuable. It affords all roads an opportunity for careful study and is of special benefit to those roads on which a comparatively small amount of mileage per active locomotive is made, since it clearly suggests the advisability of striving to effect a considerable increase in that direction and reflects the importance of increasing this factor to the greatest practicable extent.

A review of the several reports submitted by the committee shows that many roads are making little, if any, improvement in the mileage performance of their locomotives. The question is—are the carriers using this information as a means of improving their locomotive performance, realizing that a vast amount of work is required on the part of the committee to collect the data and compile these reports; and it appears to me that this fully warrants the close attention and cooperation of officials on the various roads to the end that a more nearly uniform mileage per active locomotive may result on the various roads, and that all roads may strive to attain the maximum utilization of locomotives on their respective lines, bearing in mind that it is not alone a mechanical problem but one that should call for close study and cooperation of the officers of the Transportation Department.

We should consider what it would mean to be able to improve the utilization of locomotives to the end that one locomotive would perform the service that now requires two, which possibility is clearly indicated by the comparison of the maximum and minimum mileage made per active locomotive per month.

A. G. Trumbull (Erie): A prominent member of this Association once made the statement that "locomotives should be worn out as quickly as possible." This paradoxical utterance sums up the operating aspects of the utilization program in a nut shell and any means that will accomplish this purpose will most certainly produce operating and maintenance economy and efficiency.

The report of the committee states that of 158 Class I railroads, the average miles per month per active locomotive in freight service was increased on 106 of them and the mileage per month of active passenger locomotives was increased by 80 of them. This certainly indicates a gratifying interest in the subject and should prove a stimulation to the committee whose detailed and thorough investigations have unquestionably been of material assistance to all who have had to consider the problem as related to their own conditions.

It is largely a problem for the motive power department. Every element of it which is influneced by the transportation department has long been thoroughly understood, but the possibilities for the more intensive use of locomotives, because of improved conditions of power resulting from a variety of favorable influences, have been only comparatively recently appreciated.

Much emphasis has been laid upon long locomotive runs and this is undoubtedly a large factor in the results to be secured and in their resulting economy, but, where for any reason circumstances prevent increasing the length of the runs, it by no means follows that substantial advantages may not be obtained from a study of the circumstances peculiar to such a situation.

The committee states that the governing factor in extending locomotive runs over two or more divisions is almost solely a question of proper maintenance at the dispatching terminals and proper care in handling and operating engines en route rather than to fuel, water or physical characteristics of the road. This statement is undoubtedly correct insofar as the physical problem is concerned, but it ignores certain economic factors which are vital to the problem and to which it may be profitable to devote a few moments of discussion.

The value of the locomotive to the transportation industry is measured by its earning power which is obviously the net revenue tons hauled in a minimum time per unit of tractive force, less interest on the investment, depreciation and cost of maintenance and operation. It is plain that the average mileage per locomotive per month does not measure this value and to omit consideration of the other variable factors is to ignore the most important of the purposes to be secured from efficient locomotive utilization. It would appear that a unit of measure should

be established which will account for all of the factors which are not fixed with respect of a given unit. Such a factor might be net revenue tons hauled per miles per 10,000 lb. tractive force per calendar hr. This, in connection with the average mileage per locomotive per month for convenient reference, should afford a measure of general locomotive operating efficiency, in the accomplishment of which both the mechanical and transportation departments are concerned.

Obviously a large number of factors will influence results measured by such a unit; for example: Physical limitations of the roadbed, the nature of the traffic, the size and character of the equipment, the volume and density of traffic and the geographical location of the railroad. On this account it is impossible to make any comparisons between one railroad and another which will be conclusive as to the relative efficiency of locomotive operation between them. The problem is an individual one and its solution must be obtained by a careful and detailed analysis of the operation on every division of every railroad. The nature of the required analysis has been clearly indicated by the report and discussions of this and preceding years which require no further elaboration.

It is clear, however, that the return in operating efficiency and reduced transportation cost will amply pay for the necessary investigation, but that the dividends to be realized fully justify a continuous and daily check, utilizing the measure of efficiency proposed or some other which will include all of the factors contributing to the maximum results.

If all of the elements are considered which affect the earning power, there are a considerable number which are properly excluded from consideration by the committee, such as maximum hauling capacity per unit of weight and minimum fuel and water consumption per unit of tractive power, both of which involve all of the recent developments in locomotive design as well as those appurtenances without which no modern locomotive should now be built. This is mentioned here merely to indicate the scope of the problem in its larger aspect and to add a concluding emphasis upon its importance to efficiency in transportation.

J. Purcell (A. T. & St. F.): The report that has been presented by this committee reflects a continued improvement in miles per active locomotive for the year 1925.

This committee is responsible for issuing the summary of operating statistics attached to its report and which has been furnished Class I railroads by the American Railway Association. This is a valuable report in that it reflects the mileage per active locomotive by the different roads. Practically all railroads have seasonal peak business at some time during the year and the mileage made per locomotive owned, as reflected by many reports, is not representative, due to the number of locomotives owned being governed by the number required to move this peak business. The length of time that the seasonal business lasts, as well as the amount of increase in business, varies with different roads. Where these conditions exist, the only comparative performance on utilization of locomotives must be based on active locomotives rather than locomotives owned. This will give the roads having seasonal business comparative performance with the roads having uniform business, if the former withdraw locomotives from service that are not needed. The information reflected in the report referred to is valuable to mechanical and operating officers, in that it enables them to keep in touch with the utilization of locomotives on their lines and gives them comparative figures with other roads.

The Santa Fe has followed a policy of extending locomotive runs where analyses show that economies may be effected. As a result of this study there is being operated at the present time 17 groups of extended locomotive runs in passenger service and 14 groups in freight service. The passenger extended locomotive runs average 470 miles per run and extend over from two to five engine crew districts involving 80 locomotive despatchments per day. There are also three groups of single crew passenger runs over two freight engine crew districts averaging 214 miles each. Locomotives in this service are maintained at one terminal and given only turn-around attention at the other end of the road. This operation involves 46 passenger locomotives despatched daily. There is but one main line district on the system where passenger locomotives are operating over the same length of run that freight locomotives are operated.

There are 17 main line freight districts between Chicago and Barstow, of which all but three districts operate extended locomotive runs in through freight service. These runs are operated over from two to three engine crew districts and a total of 14 extended locomotive runs in freight service are being operated on the System, the average length of which is 244 miles.

The single district locomotive runs are being operated where maintenance terminals, locomotive fuel—coal and fuel oil—and grades over divisions are such that extended locomotive run operation is not practical.

The extended locomotive run operation on the Santa Fe has been entirely satisfactory and additional and longer runs are being established.

Mr. Pack: I would like to add to my remarks that for the past year and a half the motive power, our reports indicate, is in better condition throughout the United States than I have ever seen it before, and the satisfactory manner in which the traffic of this country has been handled during the past year and a half is largely due to the interest the mechanical organizations have taken in maintaining their locomotives. There seems to be a better realization of the advantage to be derived in maintaining locomotives than I have ever seen before.

G. McCormick (S. P.): The efficient utilization of power has been a live subject for a number of years. The object has been to obtain the greatest mileage per locomotive per unit of time with the smallest fuel consumption and the least expenditure for repairs and enginehouse attention. Theoretically, this could best be accomplished by having one design of locomotive that would fit all classes of service, namely, passenger, freight and switch, which would make it necessary to hold strictly passenger locomotives for passenger service, and freight locomotives for freight service, permitting the utilizing for locomotives—first in, first out, for all service; thus reducing nonproductive time incident to holding power to protect scheduled trains. This, of course, is not feasible and we find ourselves confronted with the necessity of providing heavy passenger and freight power for heavy grade work, suitable power for runs where only slight grade is encountered, and light passenger and freight power for branch trains and locals, in addition to switch and transfer power.

Thus, with five classes of service to protect with suitable locomotives, there is considerable non-productive time charged against the power on account of being held for service.

The locomotive day of 24 hr. may be divided into three periods: first, productive time; second, non-productive time account in the hands of mechanical department for reconditioning; and third, non-productive time while waiting call for service by transportation department.

Non-productive time due to mechanical department holding locomotives out of service for repairs, is an im-

Some of the Members of the Transportation Committee

Front row, left to right: L. F. Flanagan, K. A. Milar, Wm. S. Noble, W. A. Housten, Clif Beaumont, Geo. R. Boyce (vice-chairman), Geo C. Hannaway (chairman), S. C. Dinsmore, Chas. A Beaumont, J. A. McFarland, W. H. Kinney, R. T. Peabody.
Second row, left to right: E. C. Daniels, C. C. Bailey, Geo. J. Martin, Byard L. Clegg, E. F. Gladwell, Harold H. Hendricks.
Third row, left to right: J. T. Tarpey, R. R. Porterfield, F. C. Hasse, R. S. Folk.
Top row, left to right: J. Soule Smith, W. F. Bauer, F. J. Cooledge, K. M. Hamilton, Jno. C. Keene, Geo J. Lawrence, J. C. Maxon.

portant phase of this subject to which we have given special attention, and much can be accomplished by good terminals, roundhouses and efficient shop organizations. It is also essential that modern shop tools and roundhouse facilities be provided, including hot water for washing and filling boilers. Good water supply along the road is required and should be the best obtainable, and in such localities where water is not of the best quality, it should be treated.

Considerable time has also been saved by seeing that all inspections of various appurtenances are taken care of and consequently fall due on approximately the same date. We have also arranged in yard service to change switch crews in the yard, thus increasing the time this class of power is kept in service.

The maintenance of statistics covering productive and non-productive time of locomotives necessitates the compilation of turning power reports, involving considerable clerical work, and our road decided some time ago that the results obtained did not justify the expense; consequently we now rely upon our statistics of freight and passenger train service, which are common to all roads.

It has been our practice in providing new power to purchase modern heavy passenger and freight locomotives for service on various portions of our line where the topography of the country permits the inauguration of long runs; it being necessary in many cases, to provide locomotives of suitable design and capacity to handle trains over intervening heavy grades and at the same time not have them too powerful to be uneconomical over stretches of territory where comparatively light grades are encountered. We have also placed in service in mountain territory where continuous heavy grades are experienced, heavy mountain power suitable for handling either passenger or freight trains.

We have also utilized with good advantage modern appliances and improvements in locomotive design, making long locomotive runs not only desirable but also economical. The extension of locomotive runs is a great factor, if not the greatest, in increasing the utilization of locomotives. Our experience shows that the advantages and economy of running locomotives over two or more divisions are as follows:

Increased mileage—I have yet to learn of a single case where extending locomotive runs has not resulted in increased mileage over a period of time. However, increasing the length of run 100 per cent does not necessarily mean an increase in locomotive mileage of 100 per cent, but it does usually range from about 30 per cent to approximately 100 per cent, depending on operating conditions, or, in other words, how the runs fit in with train schedule. The particular purpose is to so arrange the runs as to keep locomotives in service the greatest percentage of time.

In 1921 we placed in passenger service some heavy 4-6-2 type locomotives operating over the usual districts between Sparks and Carlin, Nevada, a distance of 288 mi., and Carlin and Ogden, Utah, a distance of 248 mi. These engines operated in this service for nine months and during that period the average mileage was 5,299 mi. The locomotives were then operated through between Sparks and Ogden, establishing a run of 536 mi., and during the first year of this service they averaged 8,891 mi. per month, or an increase of 68 per cent. One of these locomotives made 13,376 mi. in one month, and many have made over 10,000 mi. per month.

Early in 1924, we placed in service between Los Angeles and El Paso, Texas, some heavy 4-8-2 type locomotives and operated them through over the three districts, a distance of 815 mi. A check of the number of locomotives used, including helpers, during one month's operation, handling six of our important passenger trains, revealed that 132 locomotives were required as compared with 69 after long runs had been established, effecting a saving of over 47 per cent in number of locomotives used. In this territory, these locomotives are now averaging 9,300 mi. per month, and it is not unusual for a locomotive to run over 13,000 miles in a given month.

We since have established additional long runs and a few of the most notable are as follows:

Los Angeles to El Paso via South Line .....843 mi.
Los Angeles to El Paso via Inter-California R. R. and North line .....853 mi.
Los Angeles to El Paso via Inter-California R. R. and South Line .....881 mi.

Reduction in Number of Locomotives Required—An increase in locomotive mileage is equivalent to a corresponding increase in locomotives and it has been our experience that in each case when we have established long runs with suitable power, it has resulted in releasing a greater number of locomotives for assignment to other districts, thus reducing the amount of new power to be purchased annually.

C. E. Brooks (C. N.): We are much interested in the extension of the locomotive run, and I think following the example of American railroads have accomplished something both in freight and passenger service. But we have experienced difficulties which are not dwelt on to any length in the paper which has been presented to you this morning, the chief difficulty being, I believe, the use of high ash and low fusing point coal. If there is anybody that can force a modern locomotive over more than one locomotive district when they are using 25 per cent ash coal with a fusing point around 2,000 deg., I would like to meet him, because we have not met him yet.

The other points which I would like to mention, one in particular, is the very marked betterment that we have noticed in boiler conditions in running engines over more than one district. I say this advisedly because I would not say that you would get any better boiler conditions in good water territory, but in bad water territory where you are able to run your locomotives through districts with waters which help to release the heavy sulphate scales which we meet in Saskatchewan, North Dakota, in Montana and Alberta.

I think that possibly the greatest benefit we have derived anywhere is in those places where we have been able to mix up the waters and not run into foaming, and be able to keep the water clean.

The only other point which I wish to mention is the oil engine. Some of us have been working for some time past in the development of the oil engine. We may be wrong or we may be right, but there is one thing that we can take for granted, and that is that we are never going to know whether we are right if we do not go to it and try to do it.

I cannot say that the attitude of some of the locomotive builders is a great encouragement or assistance to the young railroad man who is trying to do something new, such as the oil engine locomotive. Every one of us is responsible to an executive, who is responsible either to a government or to shareholders, and we are held entirely responsible for the costs and for the failures and everything else.

Anybody going into anything as new as the development of the oil engine is in this country, or in Canada, has got to have behind him not only the confidence of the men over him, but every bit of assistance that he can get from him.

I believe that there is the greatest possibility in that

26 or 28 per cent thermal efficiency which is possible and which I believe we will obtain, too, with the oil engine.

I do not know that we are going to find that the chief field of the oil engine is going to be in switching service. I would assume that if we had something which we have been trying to get on account of thermal value, that where we get the greatest return is where the greatest amount of fuel is ordinarily used, and I would judge from that that switching service is possibly not going to be the service where we will first find the oil engine performing a real function.

I believe that we can get greater utility from the oil engine right along the line of the extended run, and can get a greater utility from this machine, and at the same time we can get the thermal capacity, and we can get the elimination of standby losses, which things are going to make the old engine the engine for the long, heavy, fast run where we are using the most fuel today.

H. T. Bentley (C. & N. W.): We have had some very good papers at this meeting, but the paper presented this morning is the nearest to our heart of everything that we have had. The question is something that we all have to face and the fact that the committee has shown an improvement in this direction indicates that we are all interested.

We have an oil electric locomotive that has been operating in Chicago about six weeks, the first one in the west. We used to operate two locomotives during the 24 hr., the oil electric locomotive runs a week at a time. We do not run it on Sundays, because the work is not there for it to do in that particular territory. It would run probably 30 days without any difficulty, if we wanted it to do it and had the business.

The question of locomotive design is one which we have been giving a lot of consideration to for a good many years, but we are imposing new conditions which we have to meet. The questions of lubrication, of fire-cleaning, of the ash pan and all that sort of thing is something that we have to pay more attention to now than we did in the past.

One thing that impresses me in connection with the successful long runs is the men doing the work in the shops in a manner that will reduce the amount of work that the roundhouses have to do. At one time on some roads locomotives were taken in the shops because they were supposed to have been maintained properly during their term of service, but I am satisfied that if the locomotives are properly repaired in the shops that they will do more to make long runs successful than anything else that I know of, and it will also reduce the amount of work to be done in the roundhouses.

There are some roads that have purchased locomotives in the last few years that were supposed to be for heavy, slow freight service. After they had had them for some length of time, the operating departments found that these engines were able to pull more tonnage and as a result put them on the main lines, and due to the increased speed with which those slow moving engines, that were designed for slow moving freight, had to run on the main lines, they were not as economical as they would have been if they had been maintained in the territory for which they were intended. So that for high-speed main line service, long runs, it appears to be absolutely necessary that the engine be specially designed for that kind of service. You cannot get a slow-speed engine to economically operate on high speeds in main line service.

O. S. Jackson (U. P.): I have been a strong advocate of long locomotive runs for some time, and, in fact, the principles as advocated by the committee have been a part of our policies on the Union Pacific for several years. We are thoroughly sold on the long locomotive runs. We find that we have reduced our cost of maintenance per locomotive mile and we have materially reduced our locomotive failures. In fact, all our main line runs have been extended to what you would call long runs, our longest run being approximately 640 mi. That is passenger service. Our average main line freight runs are 250 mi. And with some of the locomotives recently purchased we expect to put the freight locomotive on a division or a run of 425 mi. in the mountain district. Of course, we have good fuel, a fuel that is quite low in ash.

As regards to the water, we find in districts where we had a lot of trouble with foaming water, where we ran over a division of 130 mi., we now have extended that to 250 mi., running over the two divisions, the one having bad water and the other the good water. The good seems to neutralize the bad and we are getting very good results. Those contemplating permanent improvements, that is, enginehouse improvements, should very carefully study this long locomotive run problem before spending money on improvements on terminals that possibly may be eliminated.

The locomotive builders and designers have done much to improve our power to where they are suitable for the performance that is advocated by our committee.

The economic value of extended locomotive runs appears to be thoroughly established. As to that, there can be no question. And the committee properly refers to the contributing factor of correct design of locomotives for the service in which they are put. The builders will no doubt take care of that in the future, as they have in the past, and we will find that more and more attention will be paid to the design of locomotives for the particular service that they are to perform.

Mr. Vauclain referred to the possible loss of two classes of producers, to the advantage of the railroads. One was the coal miner, who is going to sell the railroads less coal. That is so much the worse for the coal miner and so much the better for the railroad. The other is the manufacturer of staybolts. And while the company with which I am connected is one of those manufacturers, they can well afford to lose that item of business if they can make locomotives that will be more suitable. The elimination of staybolts is, to my mind, one of the most important improvements that has been made. Mr. Vauclain states that in that remarkable locomotive that they have exhibited they have totally eliminated them and that is one of the great advantages of the water-tube firebox boiler. In addition to the advantage of an increase of firebox heating surface, we have gotten rid of this expensive and objectionable element, the staybolt. Too much attention and too much appreciation cannot be given to that advantage.

C. A. Seley: Having remote connection with the stay-bolt business, I do not feel entirely in sympathy with all that has been said about stay-bolts, inasmuch as there are some 60,000 or 70,000 locomotives in this country that are going to be with us a good part of the next 10 or 12 years that Mr. Purcell has allotted, and broken stay-bolts are largely because of faulty boiler design. What appeals to me in this question has been the importance of serviceability of locomotives. Presume I have worshipped the locomotive as much as any mechanical man here. I have seen the wheels go around and the pistons in and out, and all that sort of thing, with the boiler in the background. A mechanical engineer on a railroad never has time to get to the bottom of anything very much, but since I have been relieved of railroad service, I have been able to make more of a detailed study and am rather impressed with the importance of the boiler, because with good engines and a poor

boiler you do not get an awfully good record, whereas a good boiler will take an ordinary engine a long way.

The time element has come into this discussion, I think, most wisely. It is easy to make ton-miles statistics, but ton miles per hour, as referred to by two of the recent speakers, is the practical measure of what this thing means. The hours that the engines are not in service goes to the red figure side of this account, and it appeals to me that detailed attention may profitably be given to just why there are so many hours that an engine is out of service and to what extent those hours could be shortened and more available time given to the locomotive in service by a study of the boiler and its maintenance.

(*The report was received and the committee continued.*)

Report of Resolutions Committee

WHEREAS, The Railway Supply Manufacturers' Association has this year exceeded in exhibits formerly made so successfully and interestingly explained to all officers by the individual firm's representatives and have so generously arranged for the entertainment of members and families of the Mechanical Division;

WHEREAS, The Atlantic City Hotel Men's Association has provided so comfortably for our sojourn while in this city;

WHEREAS, R. H. Aishton, president, American Railway Association, and Samuel Vauclain, president, Baldwin Locomotive Works, have honored us with their presence and given such inspiring talks for the benefit of the Association at large;

WHEREAS, The *Railway Age*, as is their usual practice, has in such a prompt and fitting manner printed all committee reports and discussion and edited the daily arrivals;

WHEREAS, The committees have so fully compiled their reports and presented them in such a forceful and interesting manner;

WHEREAS, The Symington Company and American Steel Foundries have permitted the use of their testing machines in cooperation with the Committee on Car Construction in the testing of truck side frames;

WHEREAS, The Pennsylvania Railroad has so successfully arranged for special convention trains and with the Reading Company and Central Railroad of New Jersey, have so liberally provided transportation to the members and their families to enable them to reach Atlantic City;

WHEREAS, The Management of Young's Million Dollar Pier has maintained and improved conditions for our comfort in holding our meetings and visiting exhibits;

WHEREAS, The continued interest of the executives of the American Railway Association in the Mechanical Division lends inspiration to our future work;

WHEREAS, the meetings of the present convention have been so ably planned and guided by the officers, The Secretary and his staff;

Be it Resolved, That the appreciation of the members of the Mechanical Division be extended to all of the aforesaid mentioned for individually and collectively making it possible for the largest and one of the most interesting conventions ever held.

(*The resolutions are adopted.*)

Presentation of Badge to Chairman Wallis

F. H. Hardin: Under the organization of the Division, the General Committee supervises the activities of all committees.

It is difficult to lay before you a true picture of what this entails, but the statement is made to direct attention to the fact that after all the bulk of this work falls upon the shoulders of your chairman, whose duty it is not only to preside at the annual meeting, but to preside at all meetings of the General Committee and to conduct the business of the Association during the interim.

It is only fitting and proper, therefore, that the Association should make due acknowledgment to our retiring chairman for those services. I am grateful that it fell to my lot to make this presentation. I can thus personally make acknowledgment and I can state with full knowledge of the situation that not within my recollection have the affairs of the association been conducted with more celerity and in a more unbiased manner. It is with pleasure, therefore, Mr. Wallis, that I present to you, on behalf of the association, this badge, which is symbolic of your devotion to duty and of a service well rendered.

I wish also to propose to the convention a resolution, to be presented to Mr. Wallis in permanent form:

RESOLVED, That the members of the Mechanical Division, American Railway Association, assembled in convention in June, 1926, take this occasion to express their appreciation to MR. JAMES T. WALLIS for the excellent and painstaking services he has rendered in the performance of duties imposed as Chairman of the Mechanical Division and Member of the General Committee.

I propose you the adoption of this resolution by a rising vote.

(*The motion was unanimously carried by a rising vote.*)

Mr. Wallis: I want to thank my friend Mr. Hardin for the very kind things he said about me and again thank you for the consideration and courtesy which has been extended to me during the year.

I will keep this badge and this resolution in recollection of those very kind things.

Mr. Hardin: We have in our association one who is painstaking always in his duty and who is valuable to every member of this Association and to all of its committees, especially to the General Committee, and most especially to the Chairman. I am quite sure our retiring Chairman will agree with me. I would like to propose a rising vote of thanks to our Secretary, Mr. Hawthorne.

(*The motion was unanimously carried by a rising vote.*)

Secretary Hawthorne: Thank you very much.

Chairman Sillcox: I want our Vice Chairman to say a few words.

Mr. Smart: We have not given serious thought to passenger equipment. The steel equipment has only been developed in the last few years. And I am sure that we are not looking into the deteriorating effects of the use of improper materials in the construction of steel cars. I recall seeing some passenger cars on which we have had to renew the roofs within ten years. I believe that we should exchange our ideas on the construction of passenger cars, even if it is not used in interchange.

Remarks by Chairman Sillcox

Chairman Sillcox: I want to take the opportunity of thanking the younger men who took part in the discussions. I was impressed with one thing that Mr. Smart said, namely, that we did not talk much about passenger car equipment because it was not used in interchange. I think probably we do not talk about the man performance for that same reason. The matter of handling apprentices properly is subject to constant review. The same is true of the handling of foremen. We have to get the message across to the foremen, the apprentices and the men on the job. How best to do it, is left to our individual judgment.

We need to give encouragement to the different associations which are doing good work. I speak of the Air Brake Association, the Master Boilermakers' Association, the American Railway Tool Foremens' Association,

the International Railway Fuel Association, and all the others because they look to us for guidance and this association must lead in this field.

I went to the tent containing the bus exhibit yesterday and I am sure that I went through the same experience that many of you did. I found I knew very little about the bus business and yet I know that questions pertaining to them are going to come to us more seriously all the time, and we, as a body of mechanical men, ought to be considering that subject. As the mechanical heads of these various administrations, we are going to be called upon to decide these questions, and if we are not able to answer them, somebody else is going to handle the work.

I want to thank you again for the honor you have shown me in choosing me your chairman. I feel the responsibility of the task and I realize my own limitations. If you will be patient, helpful and constructive, I will try and do the things you want done.

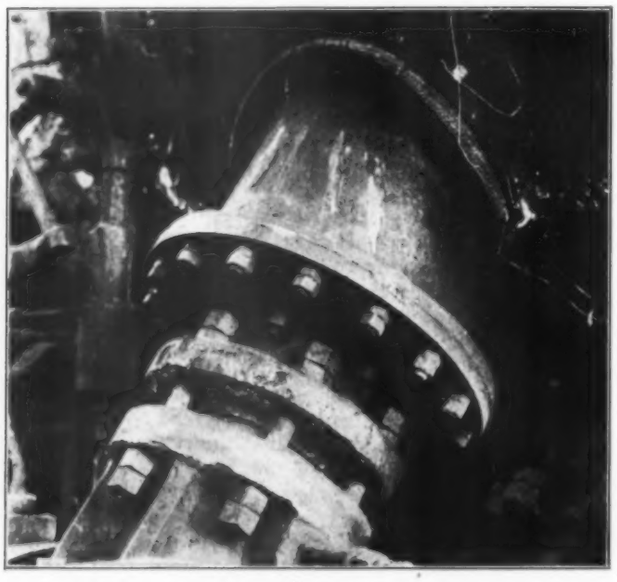
(*The convention then adjourned.*)

New Devices

Stevens Stay-Tite Casing for Steam Pipes

STEAM pipe and casing for locomotives, patented by H. V. Stevens, Topeka, Kan., designed to prevent air leaks, is being exhibited at booths 414 and 416.

For new locomotives, the steam pipe is cast with a flange above the cylinder flange in order to make the joint



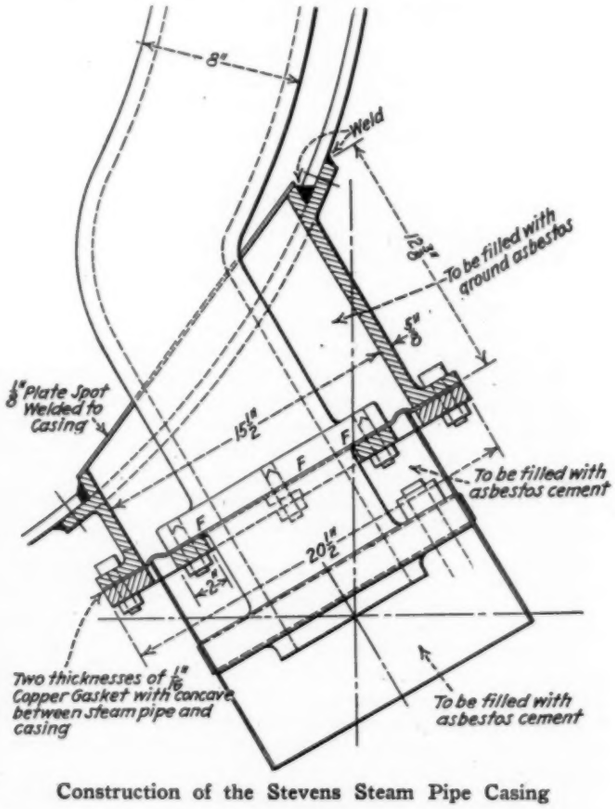
Stevens Stay-Tite Steam Pipe Casing Welded and Bolted in Place

between the pipe and the copper gasket which closes the opening between the casing and the pipe. The casing is made of cast steel and the joint at the smokebox is welded so that the expansion and contraction will not break the weld. This eliminates air leaks at the smokebox joint. The material is such that it will expand and contract the same amount as the smokebox material so that there will be very little strain on the weld at the smokebox. The copper diaphragm at the lower joint will also relieve the strain in any direction at this point. This arrangement should run almost indefinitely without any leaks. The nuts on the studs of the steam pipe joint proper, where it is fastened to the valve chest, can be readily tightened, as they are outside of the casing.

In removing or replacing the steam pipes, the copper diaphragm may readily be split. After the steam pipes have had the necessary attention and have been replaced, the same copper diaphragm can be used again by brazing the joint where it was split and it can be pulled into place again. The copper diaphragm should always be thoroughly annealed before being put into use.

In applying diaphragms on old locomotives where it goes below the steam pipe flange, it can be pressed in one piece without the necessity of spliting it. Furthermore, the diaphragm can be applied to the regular pipe flange and the casing made of suitable size to conform to the location of the flange.

The copper gasket is annular in form and is secured to the lower flange of the casing and to the flange on the



Construction of the Stevens Steam Pipe Casing

steam pipe, at its outer and inner circumferences, respectively, by two rings. These rings are split and fitted with a lap so that one of the bolts goes through the lap on each side of each ring. This form of construction is clearly shown in the drawing.

Lagging is used to prevent the hot gases from coming in contact with the copper joint. This is not necessary to prevent leaks, but it is considered good practice, to prolong the life of the gasket. After the lagging is applied, a split sheet iron plate approximately 1/8 in. thick is tacked on the top of the casing and fitted to within 1/8 in. of the steam pipe to prevent the packing from being pulled out of the casing by the suction of the exhaust. This plate is not welded to the steam pipe.